THE ILLUMINATING ENGINEER

LIGHT LAMPS FITTINGS AND ILLUMINATION

THE JOURNAL OF

GOOD LIGHTING

OIL · GAS ELECTRICITY ACETYLENE PETROL-AIR GAS ETC.

Official Organ of the Illuminating Engineering Society

FOUNDED IN LONDON 1908

Edited by LEON GASTER

Vol. XVIII July, 1925 Price NINEPENCE

Subscription 10/6 per annum, post free
For Foreign Countries, 15/- per annum.

Special Features:

Natural and Artificial Sunlight in Health and Disease — Stage Lighting ; A Visit to Drury Lane Theatre—Electric Projector Lamps—Gas Lighting on the Railways —Illuminated Name Plates for Railway Stations—The Lighting of Factories, etc.

See Page III of Cover

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National and Artificial Sunlight in Health and Disease

ON a number of occasions in the past the Illuminating Engineering Society has had opportunities of co-operating with the medical profession, for instance in discussions on such matters as the lighting of hospitals, conditions of illumination in mines, and the effect on vision of conditions in kinema theatres, and in studios where sources of exceptional brightness or richness in ultra-violet light are used.

The discussion opened by Dr. Saleeby on "Natural and Artificial Sunlight in Health and Disease" before the joint meeting, on June 9th, was again one of deep interest to the medical profession as well as illuminating engineers, and one of obvious importance to the general public and the nation. The Society had the pleasure of the co-operation of the Sunlight League, which itself represents many different aspects of this question, and a number of medical and other experts joined in the discussion Dr. Saleeby's address, an abstract of which will be found on pp. 179-182, furnished an excellent summary of the position, and was delivered with characteristic lucidity and enthusiasm. In breaking new ground with such a subject as this it was naturally impossible to enter into all the complexities involved in light treatment of various kinds. The main object was to bring home to the public how vitally their health and well-being are bound up with the enjoyment of the light-giving rays of the sun; and to give some idea of the valuable work that is also being done in the use of artificial light in the treatment of disease.

The exact influence of different forms of radiation on the human body, the relative merits of natural and artificial sunlight in treating special diseases, the precautions necessary in grading the intensity and nature of radiation according to the nature of each case—all these are problems on which the guidance of the medical profession must be sought. But there is abundant evidence to show that in general human beings benefit by exposure to the natural light of the sun, and the old adage "where the sun does not enter the doctor comes" gains new verification from recent discoveries. All of us, therefore, can co-operate in the movement for preventing loss of sunlight and its attendant evils. The discussion showed how different experts can each do their part; the physiologist by determining the effects of sunlight and revealing its deep-seated influence on health, the architect by ensuring that buildings provide maximum access of sunlight, the electrical engineer and the gas engineer by developing scientific methods of heating and thus contributing to smoke abatement, and the elimination of the impurities which poison the atmosphere of great cities and obscure the health-giving rays of the sun.

The illuminating engineer is interested in each of these aspects, and the Illuminating Engineering Society, which brings within its fold all the various experts concerned, is in a particularly favourable position to direct their joint energies to this problem. In certain fields, for instance in discriminating between forms of radiation yielded by various lamps, and in suggesting methods of estimating the intensity, the illuminating engineer can do exceptionally valuable service.

One question that was raised in Dr. Saleeby's address, and again by various speakers in the discussion, was the question of the respective fields of operation of natural sunlight and its artificial substitutes. It is doubtless true, as Dr. Saleeby and the Chairman (Mr. A. F. Berry) pointed out, that the ideal light is that of the sun, from whose rays all life on the earth is derived, and which from the earliest stages of mankind has been recognized as the great healer. The records of cures and alleviation of diseases obtained by this means at special centres in Switzerland and elsewhere are impressive. Anything that can be done to remove obstructions to sunlight, and to enable people to gain the benefits of sunlight and fresh air will be of incalculable value. But it remains true that in this country natural sunlight, despite all our efforts, is only available in its full strength for a limited portion of the year. We must therefore seek for the best artificial substitutes, including those rich in ultra-violet rays, to which much of the beneficial effects of sunlight are due.

During recent years great progress has been made in the design of lamps rich in this form of radiation. Some typical lamps were exhibited at the meeting, and are referred to on pp. 192-195. Illuminating engineers have been made familiar both with the beneficial effects and with the dangers of this form of radiation in various ways. It would be equally injudicious to regard them as necessarily noxious and to accept them as a panacea for all evils. Ultra-violet light, like other new forms of radiation, is a good servant but a bad master. We must progress slowly and surely in learning their possibilities, and apply them with discretion. The valuable work being done at the National Institute for Medical Research and elsewhere should enable us, in due course, to become complete masters of this new weapon against disease, and the Illuminating Engineering Society, to whom this field of work makes a special appeal, will account it a privilege to participate in this great movement for the application of light in the interests of the health of mankind.

The Ultra-Microscope and its Applications in Cancer Research

MUCH interest has been excited by announcements of the work of Dr. W. E. Gye and Mr. J. E. Barnard, which suggests that the virus of cancer has at length been experimentally perceived. A preliminary account of the work is given in two communications by Dr. Gye and Mr. Barnard respectively, published in *The Lancet*.* The purely medical side of the problem we must leave to physiological experts. But Mr. Barnard's researches, which deal with the physical side—the detection of minute objects by microscopic means—have a direct interest to illuminating engineers, and can be judged with more precision. Pathologists have long recognized the limits set to their investigations by the resolving power of the microscope. Recently, by the aid of the "dark ground" method used in the "ultra-microscope," as the term is generally understood, this limit was advanced materially. This method involves the illumination of the particles studied, by light projected sideways thereon, so that they are revealed as luminous specks. Minute particles may then be seen in the same way as the distant stars are made visible—simply by their high luminosity.

By this method it has been found possible to observe the movements of clusters of small organisms, and much useful information has thus been obtained. But even this method, apparently, did not suffice in Mr. Barnard's researches on the cancer virus, and it was necessary to adopt another line of attack, the substitution of ultra-violet for visible light. According to a well-known principle, the power of resolution of the microscope is a function of the wavelength of the light used. The adoption of light from a spark between metallic electrodes has brought down the limit of resolution below that of elements 0·25 micron in diameter. Visible light extends from about 700$\mu\mu$ (red) to 400$\mu\mu$ (extreme violet). In some experiments of Mr. Barnard rays of wavelength 257$\mu\mu$—far beyond the visible limits—were used. This is believed to be the shortest wavelength ever used in this form of microscopic work.

The description of the special apparatus used in these experiments is somewhat complex, but it has features of great interest. One of the main difficulties in the use of ultra-violet light has always been that of focussing; the image is invisible, and for various reasons it is not desirable to make the exposure long, nor to use a fluorescent means of observation. Mr. Barnard accordingly adopts an ingenious expedient whereby the green line in the spectrum of a mercury-vapour lamp may be substituted at will for the ultra-violet light, thus serving to secure visibility and for purposes of search and location. A further calculated adjustment ensures correct focussing of the ultra-violet image on a photographic plate.

The whole research forms a brilliant example of the good results attending co-operation between the physicist and bacteriologist. If, as is hoped, these researches lead to a recognition of the nature and cause of the scourge of cancer, Dr. Gye and Mr. Barnard will have rendered a signal service to mankind. The investigation shows once more how experiments may lead to unforeseen results of vast consequence to humanity, and emphasizes the national importance of encouraging such investigations as those of the Medical Research Council under the Department for Scientific and Industrial Research in a generous and far-sighted manner.

* July 18th, 1925.

The Lighting of Factories and Workshops

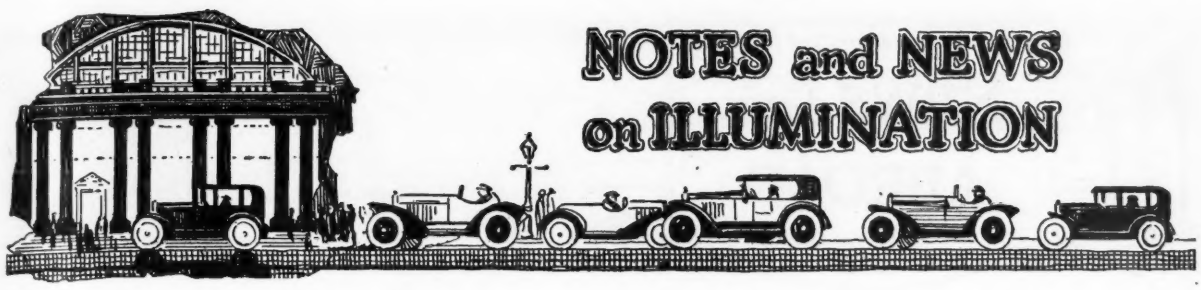
THE Report of H.M. Chief Inspector of Factories, Sir Gerald Bellhouse, for the past year contains evidence that the recommendations of the Home Office Departmental Committee on Lighting in Factories and Workshops are bearing fruit. The two years that have elapsed since the issue of the Third Report have been utilized in bringing these suggestions to the notice of management and labour in various industries. In particular, the classification of processes as "fine" and "very fine" work has been discussed. Great interest has been shown in the subject, and offers to send an inspector equipped with an illumination photometer to examine conditions under which processes are carried on have been warmly welcomed. The chief difficulty has been to respond to the numerous inquiries, and to follow up all suggestions made by workers.

Meantime measurements so far made have yielded interesting and in the main encouraging results. In many factories the suggested minimum of 3 foot-candles for fine work has been exceeded. Of 206 readings taken in tailoring workshops in various towns 169 were found to be over 3 foot-candles and 88 over 5 foot-candles. Similar favourable results are reported in hosiery factories, and one recently equipped installation furnishing from 13 to 23 foot-candles (where formerly only 1 foot-candle was provided!) is recorded.

It should not, of course, be assumed that all factories are yet adequately lighted. But these results show clearly the responsiveness of the management to suggestions, and the useful educational work of the Home Office in this field. As we predicted, the decision of the Committee not to impose legal limits for working illumination, but only to recommend values easily attained in practice, has been fully justified. Employers and workers recognize that these suggestions are made in their interests; and it is already clear that the minima recommended will be in practice exceeded by enterprising firms—instead of being grudgingly complied with, as might have been the case with stringent legal minima.

Some industries have not yet sufficiently responded to recommendations. In some spinning and weaving mills, and in brush-making and cardboard box making factories, the amount of light provided is still too low. This, it is believed, is not due to desire to economize in gas or electricity, but to neglect of upkeep of lamps and fittings. They will, no doubt, be favourably influenced by further educational work.

The Report emphasizes the importance of avoidance of glare. In some cases new lamps are inserted in old fittings unsuited to them, and there is some danger that, unless care is exercised, an improvement in illumination may be accompanied by increase in glare, and its benefits largely lost. This is a point we have always insisted upon. Employers and workers should be taught that good lighting is not merely a matter of high illumination, and that other requirements, such as avoidance of glare, inconvenient shadows, etc., must be also complied with. Our thanks are due to the Chief Inspector for the sympathetic interest he is taking in this matter. The recent depression of trade, and the relatively small amount of work done by artificial light in many industries, even during the winter period, have not been very favourable to propaganda in favour of better lighting. But we hope that the next Report will contain evidence of a still greater advance towards scientific methods of illumination in factories and workshops.



National Physical Laboratory
Annual Visit

The usual inspection by the General Board of the National Physical Laboratory, which offers an annual opportunity to men of science to visit the Laboratory and keep in touch with new developments, took place on June 23rd. The growth of activities of the Laboratory was well illustrated by the programme of exhibits, ranging from the Aerodynamics Department to the Wireless Division. Of chief interest to those concerned with illuminating engineering were the buildings devoted to optics and electrotechnics, the latter including demonstrations of photometry. Work with colorimeters, of which the Laboratory has a variety of types, and heterochromatic photometry are dealt with in the optics building. The spectrophotometer embodying the Lummebr Brodhun contrast field is a particularly interesting apparatus. Photometry, as usual, included measurements of standards, life-tests of electric lamps, determination of mean spherical candle-power, etc. To architects the Illumination Building, devoted to investigations of daylight illumination and predetermination of conditions by the aid of large scale models, is particularly interesting. Some excellent work has been done by the Laboratory in this field, and we have no doubt that the expenditure on this special experimental building, the only one of the kind in this country, will be well repaid by results.

The Association of Special Libraries and Information Bureaux

In our February issue we referred to the work of the Organizing Committee of the above Association, following the successful conference held at Hoddesden in September last year. The Standing Committee has been fortunate in obtaining assistance from the Carnegie United Kingdom Trustees, and it is now proposed to hold the second conference of the Association at Balliol College, Oxford, during September 25th/28th, 1925. It has now been decided that the name of the body is to be "The Association of Special Libraries and Information Bureaux." We are in cordial sympathy with the aims of the Association, and it may be recalled that Mr. L. Gaster is a member of the Organizing Committee. The need for well-equipped specialist libraries is manifest; in the case of illuminating engineering such a library, concentrating the information distributed in many different fields, would be particularly welcome. Full particulars of the forthcoming conference may be obtained from the Organizing Secretary at the offices of the Association, 38, Bloomsbury Square, London, W.C.1.

Women's Engineering Society Conference at Wembley

The Women's Engineering Society, in co-operation with other women's organizations, showed enterprise in arranging the International Conference of Women in Science, Industry and Commerce at Wembley during July 15th/17th. The Conference was opened by H.R.H. the Duchess of York, and the speakers included Viscountess Rhondda (commerce), Miss Ellen Wilkinson, M.P. (industrial organization). A tour of the Exhibition was arranged, and speakers and delegates were entertained to luncheon at the Wembley Garden Club by the President and Council of the British Electrical Development Association. There were four sessions, devoted respectively to engineering, chemistry and research; industrial welfare and factory inspection; commerce and salesmanship; and electricity and domestic science. The papers read in these various sections were exclusively by women, and illustrated the wide field of the woman worker of to-day.

We have watched with great interest the development of the Women's Engineering Society and its electrical offshoot. The progress made must be very encouraging to its President, Lady Parsons, and to its efficient Secretary, Miss Haslett. The Illuminating Engineering Society, from its commencement, opened its ranks equally to both sexes, and we have often given expression to our belief that women are destined to play an important part in the movement for securing better lighting. We therefore witness with pleasure this evidence of their extending activities, and regard them as valuable allies in the cause with which we are concerned.

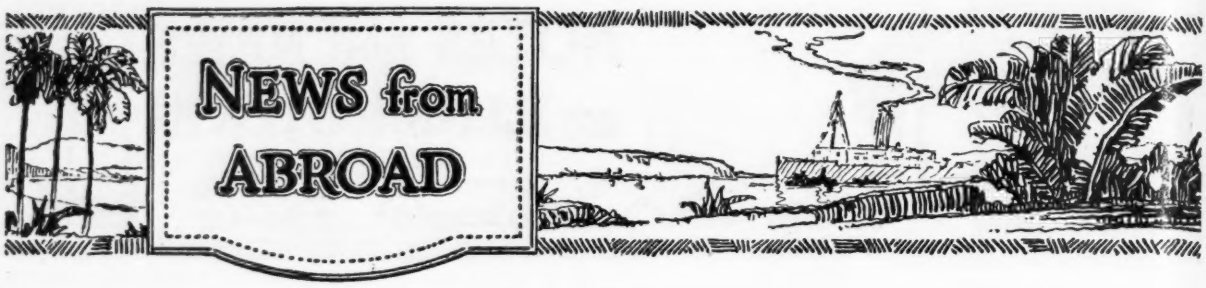
The International Congress of Radiology

The International Congress on Radiology, held in London during June 30th/July 4th, served to show very clearly the advances being made in this subject, and the wide field of work included under "Radiology." The discussions were divided into three main groups: (a) Physics and Radiology, (b) Radiology, and (c) Electrotherapy. Over 140 papers and addresses were read, a feature being the communications from experts from many different countries. Radiology in fact has, like illuminating engineering, become a truly international subject. An interesting event was the delivery of the Silvanus P. Thompson Memorial Lecture by the Duc de Broglie. A memorial lecture on the "Relationship between Radiology and Surgery" was given by Sir Berkeley Moynihan. Professor Sir William Bragg opened the discussion on "International Units and Standards for X-ray Work." Professor Leonard Hill read a paper on "Sunlight and Artificial Sunlight Treatment," and there were many papers, by Dr. Eidenow, Professor Carl Sonne and others, dealing with effects of ultra-violet light. There was also, in the basement of the Central Hall, Westminster, a very comprehensive exhibit of apparatus associated with X-ray work and electro- and actino-therapeutics. Coming after the discussion before the Illuminating Engineering Society on "Natural and Artificial Sunlight in Health and Disease," summarized in this issue, the Congress is of considerable interest, aptly illustrating the opportunities for co-operation between the physiologist, the physicist and the expert on light.

CORRECTION.

We have been asked to draw attention to the following corrections in the article entitled "A New Criterion of Street Lighting Excellence," by Mr. L. B. W. Jolley and Mr. C. A. Morton, which appeared in our last issue. The correction relates to Fig. 9, page 159.

		Diversity Factors.		
Fitting No. I	4·0	should read	2·8
,, ,, II	3·5	,,	,,	7·2
,, ,, III	4·45	,,	,,	4·0
,, ,, IV	1·10	,,	,,	0·85



The 1925 Convention of the Illuminating Engineering Society (U.S.A.)

We understand that the nineteenth annual convention of the Illuminating Society in the United States will take place during September 14th/18th, at Detroit, Michigan, a city which is remarkable alike for its industrial development and its beautiful surroundings. A good programme of papers is being arranged. A complete session will be devoted to motor-vehicle lighting, with papers by a number of well-known authorities, covering such topics as State regulation of headlights, depressible beam headlighting and the latest developments in traffic control systems. Another session will be set aside for a symposium on natural lighting, which will be held under the leadership of the Society's Committee on Natural Lighting. There will also be a symposium on residential street lighting. Among the other topics which will be discussed are: Show-window lighting, high-intensity industrial lighting, flood-lighting, computations, recent developments in neon lamps and photometry of asymmetric lighting units.

Illuminating Engineering Nomenclature and Photometric Standards

A booklet dealing with the above subject, issued by the Illuminating Engineering Society (U.S.A.) and approved by the American Engineering Standards Committee, is now to hand. The Committee of the Society dealing with nomenclature and standards has issued similar revised lists at intervals since 1910, the last revision being in 1922. The main definitions in the present series follow closely those adopted by the International Illumination Commission; generally speaking, in the choice of symbols efforts are made to avoid conflict with those devised for other work—for instance, by the International Electrotechnical Commission. The list of definitions now presented is very comprehensive, upwards of seventy quantities or processes being defined. The data at the end explaining the "lambert" and its subsidiaries are useful, as this unit of brightness is not very familiar in this country.

Illuminating Engineering Society in Germany

We note that the annual meeting of the Illuminating Engineering Society in Germany will be held in Munich during October 2nd-3rd. It is hoped that the programme of papers will be available by the end of August. Meantime it is announced that October 2nd will be devoted to the discussion of Street Lighting. On October 3rd a visit will be arranged to the Museum (where, it may be recalled, there is a representative collection of lamps of historic interest).

A "Light and Colour" Exhibition

It is announced that a special "Light and Colour" Exhibition is to be held in Essen in the spring of 1926. Practically everything covered by this title will be dealt with—the qualities of natural light, the stars, artificial illuminants of all kinds, photography and kinematography, etc. Experts will co-operate in the planning of the exhibition, and every effort will be made to render it of genuine scientific interest.

The Illuminating Engineering Society for Rhineland and Westphalia

We have already noted, early in the present year, the formation of yet another local Illuminating Engineering Society in Germany, in the Rhineland and Westphalian district. According to an account published in *Licht und Lampe*, the Society is meeting with an encouraging response. In its programme it recognizes the necessity for co-operation with architects, and is also making a special feature of efforts to improve shop window lighting by means of more local contests, etc. In this field, it is remarked, not merely *more* light but *better* light is needed. The annual meeting of this body has been arranged to take place in Cologne on September 29th, when a series of useful papers will be read.

The Effects of Ultra-Violet Light on Pigments

Research by Mr. G. F. A. Stutz, summarized in the Journal of the Franklin Institute, throws some light on the question of the fading or discoloration of pigment-surfaces. The author's primary aim was to study reflection of ultra-violet light, and numerous diagrams of reflecting power throughout the visible and invisible spectrum are presented. These data have a distinct bearing on permanence. Organic materials which allow the ultra-violet rays to penetrate are quickly decomposed. Moreover, a transparent inorganic pigment may transmit the harmful vibrations and allow them to be absorbed by an opaque organic vehicle, with the result that the pigment particles decompose and become unattached; that is, the film will "chalk." Often the addition of an opaque pigment (such as zinc oxide, chrome-yellow or lamp-black) to a transparent pigment will decrease chalking. It is true that light is only one of many factors responsible for the deterioration of a paint-film. But the investigation shows that it is an important one. The general conclusion is that in order to afford complete protection, a pigment should be opaque to ultra-violet light.

The Effect of Illumination on the Speed of Letter-Sorting

Readers will recall that in our April issue an account was given of some comprehensive investigations on post-office lighting, contributed by Dr. J. E. Ives, of the United States Public Health Department. We have now received from Dr. Ives a summary of further tests on the relation between degrees of illumination and the speed of letter separators—a form of work which appears to illustrate specially well the close relation between good lighting and efficiency of work. The tests appear to have been of a very thorough character, and we hope to give some account of them in our next number.

The Cologne Fairs

In connection with the Cologne Fairs, which take place twice yearly, prizes are being offered for the best short article on the value of business fairs to selling organizations and for industrial propaganda. Full particulars may be obtained from the London Representative (Stanley House, Dean Stanley Street, Westminster).

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

Natural and Artificial Sunlight in Health and Disease

Joint Discussion with the Sunlight League and Other Bodies Interested

(Proceedings at the meeting of the Illuminating Engineering Society, held at the House of the Royal Society of Arts, 18, John Street, Adelphi, London, W.C., at 8 p.m.. on Tuesday, June 9th, 1925.)

A MEETING of the Illuminating Engineering Society was held at the house of the Royal Society of Arts (18, John Street, Adelphi, London, W.C.), at 8 p.m., on Tuesday, June 9th, Mr. A. F. BERRY presiding.

The minutes of the last meeting having been taken as read, the Hon. Secretary announced the names of the following applicants for membership:—

Hughes, E. H.....E.L.M.A. Lighting Service Bureau, 15, Savoy Street, London, W.C.

Tayal, H. K.....Manager of the R.J. Electrical Engineering Co., Rajamandi, India.

The names of applicants announced at the last meeting were read again, and these gentlemen were declared members of the Society.*

The Chairman then called upon Dr. C. W. SALEEBY (Chairman of the Sunlight League) to give an address on "Natural and Artificial Sunlight in Health and Disease," of which the following is an abstract:—

Natural and Artificial Sunlight in Health and Disease

(Illustrated by Lantern Slides).

BY C. W. SALEEBY, M.D., F.Z.S., F.R.S.Edin.

(Chairman of the Sunlight League; Author of "Sunlight and Health").

The Mediterranean sunlight, in which our civilization was born and nurtured, was used in medicine by Hippocrates 400 B.C. Arguments regarding priority amongst modern advocates are therefore superfluous. After the rebirth of learning Bonnet used sunlight in Lyons in 1845 for the cure of what is now called "surgical tuberculosis." In 1900 Dr. T. A. Palm (nat. 1848) showed that rickets, a disease of growth, occurs where children are without sunlight, and vice versâ. His magnificent paper was ignored and a generation was lost until, thanks to an American student, my attention was drawn to it in New York in 1922. Three years after Palm the late Dr. Niels Finsen began to cure tubercle of the skin by sunlight and by electric light from a carbon arc in Copenhagen. A decade later, Dr. A. Rollier began to cure so-called "surgical tuberculosis," after the ghastly failure of surgery, by the Alpine sunlight of Leysin in the Alpes Vaudoises. In 1910 he erected the "School in the Sun."

Having protested against our urban smoke since 1902, and having vainly drawn attention to the meaning of Finsen's work at his death in 1904, I visited Leysin in 1921, and found there the clinical and hygienic reasons to explain the reduction of tuberculosis in New York, following the abolition of coal smoke, recorded by myself after visiting that city and Pittsburgh in the previous year. I began to draw attention to the meaning of Rollier's results and to ask for scientific enquiry as to the physiological processes involved. At that date we scarcely knew more than that sunlight is an antiseptic, as Finsen had realized. My plea for exact research by a committee of co-ordinated experts was supported by the late Sir William Bayliss, the illustrious physiologist, and a committee on light, with him as chairman, was set up by the Medical Research Council at the beginning of 1922. Remarkable and momentous discoveries have since followed each other, not least in this country, and the theme has now become the most important of our time in medicine and hygiene. Last year the Sunlight League was formed in order to realize for the national and racial health these and future findings of science in this field.

Two results not desired, but feared, have followed my propaganda—first, the overcrowding of Dr. Rollier's clinics at Leysin, which it was and is my ambition to to empty; and second, the purchase and use—and abuse—of all manner of artificial lamps by qualified practitioners, and also by the unqualified, in every part of the country. The time has come for at least a preliminary attempt to estimate the relative merits of the real thing and its imitations or substitutes, and for a very explicit warning as to the waste and the danger involved in the present tendency to prefer cure to prevention and the artificial to the real in the field of light.

Ever since the pioneer efforts of Finsen a generation ago, artificial phototherapy has done good work, and it does far more and better to-day than ever before. Not one syllable here is recantation of former praises; on the contrary. Research accomplished by the Light Committee of the Medical Research Council has immensely augmented our knowledge of artificial phototherapy, and has widened its range accordingly. But before we grant to these rushlights the rank of the lord of day, it behoves us to make some critical comparisons. Having made personal observations, not only in nearly all the places in this country where sunlight or its substitutes are being used, but also in New York and Leysin and Copenhagen, and having recently visited the principal heliotherapeutic institutions in Italy and France, I claim to speak with authority which cannot be admitted to certain recent writers, who are instructing us upon the sun cure, though, in instances known to myself, they have never seen the sun cure at all, even in their own country, and derive their sole experience from the use of lamps.

* *Illum. Eng.*, May, 1925, p. 119.

For the best reasons, let us begin with Copenhagen. In 1910 the local treatment of lupus at the Finsen Institute was supplemented by the general light bath, with immense improvement in the statistics of cure—which rose from 66 to 99 per cent., figures closely repeated in New York and at the London Hospital since 1922, when the general bath was added to, or even substituted for, the local. In January this year many new rooms were opened at the London. They are a delight to visit, and constitute a superb addition to the original department for the local irradiation of lupus, which was opened on May 1st, 1900, and which I began to visit in 1902. But, whilst all must rejoice at this notable recent achievement of artificial phototherapy—based upon the truth, known and practised by Hippocrates, that light is a general stimulant, and not merely a local antiseptic—the question now arises whether, when we ask artificial light to do more than cure lupus, it compares favourably with the real thing.

When I studied this question in Copenhagen in 1923, I found no evidence whatever to suggest that artificial phototherapy can take up the challenge of heliotherapy, when we begin to consider, for instance, deep and complicated tuberculosis, of the kind still called "surgical." The surgeon in charge of the new Surgical Department, with many in-patients, of the Finsen Institute, Dr. Chiewitz, was regularly performing surgical operations, such as Leysin should have made for ever anathema henceforth, and found them necessary despite all that artificial light could do. Nowhere in the published literature of artificial phototherapy in any country can be found records that seriously stand a moment's comparison with those of Rollier and his followers. Doubtless the results obtained by artificial light will steadily improve for many years to come; but even when they reach their optimum, it is inconceivable that they can equal the sunlight, as we shall see.

"Why always in a cellar? Why never out of doors?" was the inquiry put to me by Dr. Rollier himself, regarding artificial phototherapy, when he saw some installations in this country last year. Believing that pure, dry air favours his results, and recognizing the psychological value of the open air, he could not understand why he should be conveyed to one cupboard, disused cellar, or similar apartment, after another, styled the "Light Clinic" of this or that hospital. I appeal to Dr. Leonard Hill to use his great authority on this question of ventilation. He has put long years of masterly work into the study of the air, its physical rather than its chemical condition, and he is the acknowledged teacher of us all on this subject. He has lately been praising artificial light, in view of the results he has witnessed. He has not visited Leysin, but he knows Montana, and he, more than any other laboratory worker in the world, knows the value of the open air. But this is utterly ignored, I dare to aver, in every artificial light clinic in this and every other country. To anyone who knows the real thing, it is a stupid and vicious farce to visit some of these places, not necessarily a thousand miles from Harley Street, where the air may be, let us say, as unfit for human habitation as the assortment of toxic and stagnant gases in the Casino at Monte Carlo.

A singular mischance has lately given me first-hand knowledge of this subject from the patient's point of view—an interesting addendum to 23 years of study in the vertical position. A broken leg and knee and a septic wound of the hand were treated by artificial light for six weeks and thereafter by Mediterranean sunlight. To the kind and skilful clinician who served me so well in London I shall always be grateful, as are many others whom I have since served by sending them to him; but he would laugh, as I do, at the notion that his cabinet bath, though the best of the kind that I have seen, in his room could compare with, say, the beach at Alassio or even my bedroom on the Arno in Florence. Even were the composition of the light the same in the contrasted cases, the air factor and the psychological exhilaration factor are utterly incomparable. Fearing the journey, I delayed a fortnight in December, against the advice of my surgeon, who quoted Sir William Broadbent, "A man may keep well in London, but he cannot get well in London," and thought to carry on with light baths, but made no progress, whereas I was a different man in forty-eight hours after getting away to the real thing. I strongly urge that, wherever possible, artificial light clinics should be conducted in the open air. This advice will be ignored by most or all clinicians, but I record it and will recall it someday.

Common sense and the theory of evolution alike suggest that natural sunlight will probably be best for our bodies. But suppose that, however that may be, we contrive a lamp whose light is as good. Do we propose to expose patients for, say, three hours a day? It is impracticable. We cannot afford the room and the time. Therefore we must try to get, in a few minutes, perhaps twice a week, the same result as, under natural conditions, we should obtain by hours' exposure daily. Powerful lamps are therefore constructed, such that they may be ten or twelve times as productive in ultra-violet rays as the midday summer sun in London. May we now assume that five minutes of this produces the same result as an hour of that? To fill a pail with a large tap in five minutes is as effective as to use a small tap for an hour. To some extent we fill the body with energy by light, though that is probably the least of the action; but even so, its absorption is an active process—not merely the mechanical accommodation of a pail. It will be more than astonishing if we learn that two minutes of a mercury vapour lamp which deeply tans the skin have the same action on blood and bone and brain and endocrine glands, etc., etc., as two hours a day for a month of the sunlight, producing the same amount of tan.

Heliotherapy is far from foolproof, indeed, but it is child's play compared with artificial phototherapy, especially with the immensely powerful lamps now in use. Very grave accidents may and do occur. I warn the public against all unqualified practitioners of artificial light treatment; adding that very nearly all registered practitioners are entirely unqualified in this respect. Sheer destruction may be wrought by powerful ultra-violet rays. Remember the history of the X-rays and the ghastly results to many devoted pioneers, and consider that the gap between the shortest ultra-violet and the softest X-rays is not so wide. Let us observe, for instance, that someone or other has invented the theory that the value of the application of light depends upon a "reaction" said to consist in a reddening of and slight injury to the skin, which develops some time after treatmeant and remains for hours; and that the good result is due to a kind of vaccination by toxic products from the thus injured skin. One need only mention rickets to show that these theorists have forgotten it! With all due deference to distinguished names, I believe this to be nonsense which no one who had ever seen the sun cure could have invented. But, in a case which I observed last summer, its application by a well-known expert, armed with an appalling light-battery, produced the most alarming results in the hapless patient.

Anyone can buy a lamp or lamps, and touch a button and profess to practise phototherapy. The agent looks safe and simple. It is, in fact, most powerful and complex and anything but foolproof. There are not half a dozen doctors in all this country whom I would trust to treat me. I hope that the London County Council and other authorities will exercise the most rigorous care in granting licences for installations. The law permits unqualified practice in this field. Worst of all is the prospect of "Light Parlours" and so forth, requiring denudation, of course, to receive the light, and opening the way to every kind of sexual abomination associated with "massage parlours," etc. That my campaign for the light of life should lead to this prospect is too disgusting for words. *Corruptio optimi pessima*, indeed.

Lastly, observe that to use artificial light as a substitute for my ideal, proclaimed these twenty years and more, of true helio-hygiene, would cost such fabulous sums as to be utterly out of the question, even if the step, necessary in any case, had been taken, of providing for the education of doctors in phototherapy. Some

great Light Institute is urgently needed, first in London, for that purpose. The Radium Institute provides, as I have pointed out elsewhere, a perfect model for the purpose. But even if we had trained men, and lamps and money—including enough to introduce electricity into all those of our schools which at present have no instalment—and even if we had the sense to use these lamps in the open air, there is every reason to believe that we should never achieve anything seriously comparable to the results of the School in the Sun at Leysin.

The real use of these lamps is to "carry on," *faute de mieux*, when and where we cannot have sunlight; to serve for laboratory and other experiments regarding wavelengths, etc.; in the special case of the treatment of lupus; to radiate our food; and, above all, by their good results, within limits, to guide our feet back to the light of day. That the Ministry of Health should spend money on such lamps whilst it cannot find time or courage to introduce legislation against the factory chimneys of Manchester or Sheffield, nor even to require the right kind of provision for cooking, etc., in the new houses which are built under its control, is utter folly. Of course, there is and always will be the kind of mind which prefers the artificial; we have the advocates of fractionated, sterilized, humanized milk as against the breast in the field of infant care; we meet everywhere people who like champagne and dislike grapes; and others who, not actually drowning or dying of bronchitis, or mitral regurgitation, do not agree with Whitman that "the air is worth more than all perfumes"; others who prefer to kiss lips covered with red lead or whatever the muck is rather than clean lips lit with rich red blood within; but for all such and their systems there yawns the pit dug by Nature for those whom, despising her, she duly destroys.

NOTE.—Here I have not discussed the separate though vastly important theme of the uses of natural and artificial light for health and disease in respect of vision, which is the principal concern of this Society. But much enquiry is needed as to whether, for instance, the great value of light in the development of a rat, puppy, rabbit or other furred animal is not largely due to reflexes arising in the act of vision.

No references have been given in the text. They will be found in my "Sunlight and Health" (Nisbet & Co., second edition, with new matter, 1924. Price 5s. net).

DISCUSSION.

THE CHAIRMAN (MR. A. F. BERRY), in opening the discussion, said that appreciation of the value of sunlight, as illustrated in "sun-worship," dated back more than 3,000 years. Our object to-day must be to modernize sun-worship by learning how to apply the sun's rays scientifically, and eliminating obstacles to the free use of sunlight. The subject was of wide interest and demanded the co-ordinated and correlated efforts of medical men, engineers (electrical and others), physicists, chemists, painters, etc., as well as the general public. The British press was to be congratulated on the valuable educational work it was doing in drawing attention to this subject; our object should be to supply it with facts—neither overstated nor underrated. He hoped that when Dr. Saleeby had read the paper which he had kindly prepared, and others had contributed to the discussion, they would have made a material advance towards fuller knowledge.

Dr. Saleeby needed no introduction; some thirty works of his, and nearly as many years of effort in the good cause had made his name familiar, and endeared him to all interested in the application of natural and artificial sunlight.

DR. E. J. DECK said that he was a clinician, but not an expert in electrical apparatus. He had become interested in the curative use of light in 1917, when he was in New Zealand. He was there selected as medical officer to the 21st Reinforcement, and was sent to Hornchurch, where there was a big convalescent camp for dealing with wounds which other hospitals could not treat. That was his introduction to the tungsten lamp, which was believed to have the power of destroying bacteria, relieving pain and forming new tissue. By the examination of cultures of bacteria from wounds, he satisfied himself that these bacteria could be destroyed by exposure to the light of the lamp at a distance of 12 in. to 16 in.

He also found that by applying the rays to wounds where the bullet had passed right through he could heal up the apertures, but in ten days' time they broke down as badly as ever. Then by means of a probe he passed the rays backwards and forwards through the wound, and found that in these circumstances the healing was permanent. The action apparently sterilized the interior of the wound. He had also found that the rays would relieve pain, for instance, in reducing the swelling of a dislocated shoulder and enabling the patient to move his arm without painful effects. Similarly several applications were effective in the case where a lower tooth had been extracted, though all other efforts to relieve the pain in the socket had failed. Yet another case successfully treated was that of a boy suffering from a pain over the eye, neuralgia and Bell's palsy. He did not profess to be able to explain these results.

Dr. Deck also described the successful treatment with this light of a man suffering from a bad carbuncle. He was not advocating artificial light as a substitute for sunlight, but the artificial light was valuable in the treatment of many forms of disease. He had found, for instance, that applications gave relief in cases of varicose veins, by toning them up and enabling them better to perform their duty.

DR. EIDENOW said that he was present as representing Professor Leonard Hill, whose unavoidable absence he much regretted. At the National Institute for Medical Research a special study of the effects of light had been made. There was one point which he particularly desired to emphasize, namely, that in order to effect cures there must be careful nursing and surgical attention, in conjunction with exposure to air and sunlight. Both sunlight and artificial light, wisely administered, were beneficial; but if applied without discretion their effects might be bad. It must be remembered that in the treatment of the sick they were dealing with people who had lost 40 to 50 per cent. of their power of resisting disease, and in some cases trying to force the blood to do more work was like urging a tired horse uphill. In such cases the strictest care was necessary whenever light was used.

Another point was the danger of injudicious use of short rays. Happily such rays did not penetrate very far. When the most superficial layers of the skin had become to a certain extent immune longer radiations could be used, entering more and more deeply. Care must be used to grade the light to each skin, whatever the nature of the light used.

SIR RICHARD PAGET, referring to sunlight treatment, suggested that it would be a great advantage if fuller facilities could be afforded for bathing in the open air, for example, in the Serpentine. Many thousands of children did so during the summer weather, but under difficult conditions, and there was no place set apart for them to dress and undress. There was no place at all where girls and women could sun bathe or water bathe. If the Government could be induced to put up a bathing colonnade along the Serpentine it would give an opportunity of sun bathing to a large number of Londoners who at present could hardly find any place where they could indulge in this treatment.

He had been much interested in the reference to the necessity for grading the light. Many of the effects were now obtained without any certainty as to which part of the spectrum was really accomplishing the result. It was necessary to know exactly what proportion of the various rays was emitted by different lamps and to have a source of light such that both the intensity and the wavelength could be varied and an exact dose administered.

He had been surprised to observe that in the preliminary announcement of the British Association meeting next August no reference was made either to natural or artificial sunlight. He thought that this should be put right by offering to the British Association some really important information which could be put before the public on the question of the curative effects of light.

MR. D. N. DUNLOP (Director of the British Electrical and Allied Manufacturers' Association) expressed his appreciation of the paper read by Dr. Saleeby. He thought that any cause which had the advantage of such enthusiasm was bound to succeed ultimately. In this, as in other matters, progress was often delayed by vested interests, which interfered with the sweeping away of unhealthy places. He had spent much time amongst engineers, but this evening he had realized anew their great importance to society. He was glad to say that a number of men whom he met in the manufacturing world were trying very hard indeed to bring about smokeless cities. He hoped that when legislation was introduced bearing on the national use of electricity the principle that it was almost a crime to blacken the skies with smoke would be borne in mind. Members of Parliament would have their attention drawn to this question and to the great importance to this country of the proper use of electricity on a national scale.

He had been reminded, when Dr. Saleeby was speaking, that one of the oldest ideas to be found in literature in regard to man was that he was a "being of light"—having been created out of light by the light of intelligence. Most of the diseases and disadvantages under which men laboured were due to delusions of the intelligence. He believed that by the aid of the enthusiasm of such men as Dr. Saleeby and the Chairman the people would be impressed with the possibilities and beauty of sunlight and a new England would arise.

DR. JAMES KERR remarked that one of the most remarkable discoveries in connection with sunlight was the effect of light on food. He hoped that Dr. Saleeby would say something on this subject. It had been found that milk exposed to ultra-violet light gained valuable properties. On the other hand children who suffered from the surgical variety of tuberculosis often did so through the fact that the milk they drank was infected. The value of exposure of light in the treatment of such tuberculosis had been emphasized by Dr. Saleeby. But he thought they should go further back and consider the evil at its source. Cows at present were fed up and put in byres. They were kept warm and often did not get much light, so that their milk was produced under ideal conditions for the development of tuberculosis. Another matter which ought to be carefully considered was that the window glass at present used lessened the beneficial action of light.

MR. RAYMOND UNWIN said that he did not wish in the least to criticize what Dr. Saleeby had said about the shortcomings of the architects of garden cities, and the action of the Ministry of Health. The question of light had interested him for many years, and he thought it only right to say that more had been done by the Ministry and by those concerned with the Garden City Movement than might be supposed. He would like to read a quotation from a pamphlet which he had brought out in 1902 with regard to cottages. After dealing with fresh air and light he had said: "The essential thing is that every house should turn its face to the sun, whence come light, sweetness and health." He thought it would be seen that, whilst not having knowledge of scientific apparatus such as that which the meeting was considering, architects had an instinctive feeling that sunlight was valuable. In a manual issued by the Local Government Board, which became the Ministry of Health, it was laid down as an instruction that the best aspect for the living room was south-east and that it must never have a northern aspect unless sunlight could be admitted at the other side of the room.

With regard to what had been said about the good work being done at curative centres in Switzerland he had had some personal experience of this, because one of his nieces had been cured, not of tuberculosis, but of a disease which reduced her to a veritable skeleton.

With regard to the erection of new houses, the bodies responsible were the local authorities, and they were not supervised by the Ministry of Health. In a democratic country there were limits to what could be done by a central authority, and wisely so. It was, however, very important that local authorities should be stimulated to find out what could be done in regard to the erection of buildings open to sunlight. The experience of New York had shown the drawback of building up into the sky and thus cutting off a vast amount of sunlight. He believed that by proper regulation it was possible to make sunlight valuable to people who lived in urban areas.

DR. HECTOR MUNRO pointed out that light-energy affected the physical side of life; indeed, it was being proved scientifically that sunlight was necessary to life. The work of the Sunlight League had many aspects, and was important alike from the standpoints of the doctor and the public. Its primary aim was to give publicity to facts which ought to be generally known, and which in the past had been familiar to only a few, and not widely disseminated.

MR. P. J. WALDRAM remarked that attention in the discussion had been concentrated on "sunlight," and the word "daylight" had not been mentioned. He recalled, however, that at a recent meeting of the R.I.B.A. Professor Leonard Hill had stated that the curative value of light derived from the sky often exceeded that of direct sunlight. This was an important statement. As a rule there was not too much direct sunlight in this country. Mr. Waldram also referred to a view of a building in New York shown by the lecturer. The two façades were bathed in sunlight, but he would like to know the illumination available in the light-well. As a rule very little light filtered down to the bottom of a well 40 ft. or 50 ft. deep.

The laws of this country limited the heights of building severely, and from the standpoint of avoiding obstruction of sunlight this was a great benefit. Even New York was now awakening to the benefit of lower buildings. He hoped that the beneficial ancient light laws of this country would be retained; contrary to the general impression, there were in existence similar laws in Scotland, and he had been engaged in cases to defend them.

MR. J. R. QUAIN gave a brief explanation of some of the chief aims of the Sunlight League, which illustrated the need for co-operation between the medical and engineering and other professions concerned. The Research Committee of the Sunlight League was open to receive suggestions from any quarter, provided that they contributed to the solution of the problem of the best use of sunlight, and how the qualities of natural sunlight could best be produced by synthetic means. Another matter that interested the Committee was the elimination of the smoke nuisance, the investigation of the best methods of smoke prevention, and the economic as well as the hygienic advantages of such methods.

The applications of natural and artificial sunlight involved many problems. It was desirable to ascertain precisely which rays were most suitable for various therapeutic applications, so that light treatment apparatus developing particular rays might be devised. Another fruitful field of investigation was the examination of materials, so that those best suited to the free passage of the beneficent rays of the sun might receive scientific demonstration. Such materials ranged from those entering into the composition of fabrics for daily human use to those employed in the construction of buildings. Tests and experiments at various scientific institutions would be initiated, and the committee welcomed efforts in connection with the therapeutic illumination and air-conditioning of living rooms, hospital wards, factories and places of entertainment.

DR. O'DONOVAN (London Hospital) mentioned that he had started experimenting with light treatment in 1921. As soon as any results were obtained, these at once aroused the interest of Dr. Saleeby, who asked for photographs, and shortly afterwards patients began to come from all over England. Thus, instead of devoting his time to experiment, he had had to give it up to them. It was, however, fortunate that there were still people who were able to engage in research work, their time not being fully occupied in looking after the sick. Although Dr. Saleeby had suggested that medicine and surgery were no good in dealing with some of the diseases under consideration, he could state that there were men who,

without light, could save people in the smokiest towns from death. Such men were an honour to English surgery. The public must not get the impression that the work of men acting in different fields was discordant. In different areas, and frequently with entirely different materials, they were all fighting disease.

THE CHAIRMAN said that they were all grateful to Dr. Saleeby for his frank and interesting summary of the position, and to the various speakers who had contributed their individual views and experience. There were many aspects of the problem, but the Smoke Abatement and Light Ship must go forward on an even keel. The sun is always there, also the good air; our aim must be to get at them, or rather to let them get at us. The electric age is now upon us, and the opportunity will be given for towns, large and small, to profit by it. This is an age of specialization, but also of co-operation. The engineer must aid the work of the doctor, and the architect, the chemist, and many others were also interested. Whilst the cure must be left to the doctor, the engineer and architect could help in preventing people falling sick.

In pressing forward it was necessary to make sure of one's steps. Excess of ultra-violet light might prove worse than too little. The sun gives all sorts of rays, and human, animal and vegetable life have evolved under its light. Let us therefore make good use of its beneficent rays, in a natural way, remembering that living creatures in noonday sun may seek the shade of the chlorophyll screen formed by the leafy trees—the most perfectly delightful energy transformer known to man. The early sun, and that of late afternoon, hold for us what we so greatly need for the preservation of health.

We may also supplement natural sunlight by the light from artificial illuminants, but in doing so it is necessary to exercise discretion, and to see that their rays, imperfectly understood as yet, are administered under medical advice.

The Chairman also paid a tribute to the power of the Press in making these ideals widely known. The Press would always give good ideas to the public if they could get them, and our aim must be to furnish useful and reliable data.

In conclusion, the Chairman again expressed appreciation of Dr. Saleeby's inspiring paper, and proposed a vote of thanks, which was seconded by MR. L. GASTER (Hon. Secretary). Mr. Gaster, in doing so, referred to the considerable amount of work that the Illuminating Engineering Society had done on daylight, and to various discussions on the effect of light on the vision, the lighting of hospitals, etc., lighting conditions in mines, etc. In these and other matters the Society had received the co-operation of the medical profession, and it was a guiding principle with them to enlist the aid of all who could contribute to the solution of the many problems involving the application of light in the service of mankind. The present problem was one where the co-operation of the Society, the Sunlight League, and other bodies interested, could be most happily applied. Dr. Saleeby's able and inspiring address had given them an excellent survey of the present position, and he hoped that the discussion and the publicity to which it would give rise would be useful in bringing the matter before the general public, who were vitally interested. It was naturally impossible, in the time available, to enter into the details of the many complex questions involved in light treatment, but these would offer a good field for the activities of joint committees, and the Society would be glad to co-operate in research of this character.

In conclusion, a vote of thanks to the Chairman, and to those who had contributed to the interest of the meeting by the exhibit of apparatus,* terminated the proceedings.

Communicated Remarks.

W. G. RAFFÉ: The power of sunlight to purify has often been remarked in India, as in the River Ganges. Thousands of dead bodies, many of them only half burnt and charred, are thrown into it and its tributaries, yet its water remains clear and wholesome. This is perhaps due to its slow motion under a most powerful sun under a smokeless sky.

The Hindus themselves apparently benefit much from the sun, for the mothers rub the little ones over with butter and let them run naked in the morning sun. When grown they habitually walk nearly naked; they cover the head and the mouth most of all. Their daily bathing is well known, also in early morning.

The influence of light on the blood stream may very probably compare with the analogous influence of light or sap streams in trees and other vegetation. The magnetic index is changed and causes the rise in spring. It would be useful to compare blood specimens by the Abrams E. R. A. tests after subjection of the patient to curative light. Obviously light can exert influence only when life is present; light improves living colour and fades dead colour. Hence, it is not correct to say that "light builds tissue," rather it permits tissue to get on with its own building. The reaction between yellow sap and blue light produces green chlorophyll. In the blood stream the index is completely opposite, and yellow serum with blue light produces red blood, tending towards blues when the basic serum is vitiated.

The use of the ultra-violet rays in the United States to purify water streams, when the water contained in a public bath is circulated through a suitable rotary pump, and is directed by baffle plates against the outer side of a quartz mercury vapour lamp in the centre, is of interest in this connection. Mr. W. F. Walker, Deputy Commissioner of Health, Detroit, Michigan, U.S.A., after a thorough investigation of method of purification by ultra-violet rays, as applied to swimming pools in the city of Detroit, states in his report, published in the American *Journal of Public Health*, April, 1922, that "Sterilization, by ultra-violet rays, of swimming pool water is a recirculating system properly designed and operated, giving a water in the pool which compares favourably with the Government standard for drinking water."

Here the drug problem is also met. Water has often been treated, especially for troops, with substances such as chlorine, which are definite poisons. It is fully proved that water can be sterilized, if suitably filtered, to remove turbid matter as well, without any chemical alteration, simply by submission to the ultra-violet rays. It is therefore highly probable that similar effects could be obtained in the human blood stream by inserting a small quartz tube in a vein and treating with a very small lamp, hardly more than a spark, for cases where rapid improvement is desirable. In cases where transfusion is carried out, such a tube acting as part of the carrier, might be used in purifying the blood in transmission.

The word "colour" was barely mentioned, yet it must be evident that most abnormal cases need some colour variation. The full and unaltered sunlight is obviously the treatment for normal people. For abnormal cases, however, some partial bias to one or other colour may be necessary, according to whether growth is to be destroyed or tissue stimulated. It is, for instance, not desirable to use rays which aid growth of tissue when trying to eliminate a tumour. It is evident that light has destructive as well as accumulative powers, which, however, also react differently in each individual, according to the balance of vital energy present.

But in general it is necessary to endeavour to establish the laws of these actions. Light is an electro-magnetic phenomenon, and so is the vitality of the human body. We have to observe the reactions between the two, in normal cases, as a guide to action for the abnormal cases. Here the study of effects under artificial light, which can be absolutely controlled and, moreover, measured, will be of great value. It is also necessary to disabuse people of the notion that they are only personally influenced by light or colour of environment, etc., when they are consciously looking at it; for a blind

* A description of these exhibits appears on pages 192-195.

man reaps benefit from colour, as from sunlight, in the same physical measure as a sighted man.

MR. W. M. MASON: All success to the propaganda for more natural sunlight. The pity is that while the *arguments* are all in favour of sunlight, the *practice* of so many, even amongst the advocates of it, still makes so largely for continuation of the filthy air conditions which either effectively obstruct it, or filter those rays which are so beneficial to public health.

The astonishing inconsistence of some people who, on the one hand admit and advocate the value of sunlight, and on the other still talk about the *romance* and delights of the open coal fire, and continue to burn coal, would be amusing if it were not so pathetic. The burning of raw coal has been proved to be the greatest source of air pollution, and this in spite of the fact that excellent substitutes are available.

As a rule, and taking the whole household budget into account, these modern substitutes—gas and coke—are more economical, besides being incomparably cleaner and more hygienic. As the most practical solution of the smoke menace and its allied evils, the part which gas plays in the homes of the nation is a significant feature of modern development. What would London or any of our other large cities be like if the millions of gas appliances were withdrawn?

With such substitutes for raw coal available it is a crying scandal that the continued burning of raw coal should be allowed, with the accompanying pollution of the air we breathe and, incidentally, the destruction of those invaluable products—sulphate, tar, dyes and drugs—stored in it by an all-wise Creator. The proper place for those products is, surely, the sunshine factories commonly known as the gas works, where coal is scientifically heated so that the good things are retained, and clean, adaptable and economical smokeless fuel is produced. Whenever we see a gas-holder we should instructively think of it as the symbol of *More Sunshine*.

A Survey of Lighting in 800 Retail Shops

Since our last issue went to press we have received the following communication to the discussion on the paper by Messrs. W. J. Jones and H. Lingard on the above subject:—

MR. T. C. FREETH (communicated): Beyond endorsing the appreciation of this paper expressed by numerous speakers, I have no comments to make on the paper itself. I am, however, disappointed to notice that throughout the discussion there has been a tendency to give what I think I am justified in calling undue prominence to the mercenary side of the question of shop lighting.

Several speakers have referred to the benefits which will accrue from better shop lighting to the electrical industry as a whole, and also the shopkeeper, from the point of view of ensuring an increased turnover for both, but surely the most important aspect, and certainly the one with which the Illuminating Engineering Society should be chiefly concerned, is the way in which this improved lighting will affect the public. Undoubtedly the public will benefit just as much, for although a well-lighted window may attract the public, at the same time it enables the public to see clearly what is being offered for sale. Further, a well-lighted interior enables purchases to be made more quickly, and with the confidence that every detail has been seen, thus eliminating the irritating occurrence of discovering after the goods are delivered that they look quite different because the light in the shop where they were selected was so bad.

Department of Scientific and Industrial Research

The Lord President of the Council has appointed Mr. R. S. Pearson, C.I.E., F.L.S., Forest Economist, Forest Research Institute, Dehra Dun, India, to be Director of Forest Products Research, under the Department of Scientific and Industrial Research.

Mr. Pearson will be in charge of the Forest Products Research Laboratories, in which pure and applied scientific research will be carried on to meet the practical needs of the using industries and of Departments of State.

High Illuminations and Possible Eye-Fatigue

A CONSIDERABLE number of tests have recently been made with the object of ascertaining the extent of the advantages derived from higher industrial illuminations. Much naturally depends on the nature of the process, but experience leads to the belief that, in many cases, by using higher orders of illumination, the efficiency of work and possible output are materially improved. (It is, of course, assumed that the higher illumination is accompanied by proper attention to other factors—for instance, that glare and inconvenient shadows are guarded against.)

The question has been raised, however, whether, in spite of the improved efficiency, these higher illuminations may be prejudicial in causing increased eye-fatigue. This is a matter that can be examined to some extent in the laboratory, and in a recent contribution Professor P. W. Cobb and Mr. F. K. Moss describe some experiments made for the Lighting and Illumination Committee.*

It was first necessary to devise a process which could be regarded as comparable with exacting work in practice, and secondly to adopt some means of measuring fatigue. A process was devised such that the amount of work done by high and low illuminations in a given time was the same; in these circumstances any indication of greater fatigue could only be attributed to the difference in illumination. The operation consisted in watching a rotating white disc with symmetrical black dots round its periphery, and pressing a key whenever a certain dot was exactly opposite a corresponding dot, in an adjacent stationary series. The eye of the operator was thus kept constantly occupied. The test often left the eyes of the worker in a reddened and watery condition, and there was no doubt that the process induced fatigue. As an indication of the extent of the fatigue, the "muscle-balance" of the eyes was tested before and after the test.

The records show that the number of times the key was pressed and the "score" of correct observations was the same, both with a brightness of 5 ml. and with 100 ml. But though the imposing of the test showed a material shifting of the muscle-balance, the extent of the change appeared to be almost identical in the two cases. It was therefore concluded that the mere fact of the illumination being twenty times as great in one experiment as it was in the other did not occasion any additional fatigue.

(According to this test, the process was such that the "efficiency" of the operation was the same by both illuminations. But the question arises whether, if, owing to the higher illumination, more work can be done in a given time, this increased production would not be accompanied by greater fatigue.)

British Engineering Standards Association

The British Engineering Standards Association has recently issued an indexed list of British Standard Specifications and Reports, which illustrates clearly the large amount of valuable work that is being done by its numerous committees. Copies may be obtained from the Publications Department (28, Victoria Street, Westminster, S.W.1) at a cost of 1s. 2d. each post free.

The work of the Association deserves every possible encouragement. There are now several sub-committees working on the standardization of illuminating glassware, street lighting, standard specifications for illumination photometers, etc., and their reports will be awaited with great interest.

* *Journal of the American Institute of Electrical Engineers*, June, 1925.

A Visit to Drury Lane Theatre and Discussion on Stage Lighting

(Proceedings at the Informal Meeting of the Illuminating Engineering Society on June 23rd, 1925)

BY the courtesy of Sir Alfred Butt, a visit to Drury Lane Theatre was arranged on Tuesday, June 23rd, for the purpose of inspecting the stage lighting equipment. A large number of members and friends assembled at the stage entrance at 5-30 p.m. Subsequently, by kind invitation of the General Electric Co., Ltd., most of the party adjourned to Magnet House, where tea was provided, followed by an informal discussion on stage lighting.

Mr. H. Mather, the Chief Electrical Engineer at Drury Lane Theatre, received the party, and gave a demonstration of the stage-lighting equipment, which presents many interesting features. There were particularly good opportunities for comparing modern practice with older devices, as the latter had in some cases been retained for use in conjunction with the up-to-date plant. A comparison was made, for example, between the "limes," i.e., oxy-hydrogen limelight projectors, and projectors equipped with high candle-power gasfilled lamps. The former appeared to give a softer lighting effect, but could not be controlled with the ease of an electric lamp working on a dimmer. The limelight, however, showed practically no trace of flicker until it was turned low. Attention was called to the difference between battens fitted with modern reflectors and the older style with a simple painted surface behind the lamps. Vertical floodlights over the front of the stage were exhibited and their control explained. The high-power arcs for illuminating the stage from above the gallery were put on singly and in conjunction with the other lighting. The intensity and wide distribution of the illumination from the arcs above was remarkable.

In addition to the spotlights and special lamps for illuminating the panorama (a distinctive feature at Drury Lane) the inspection covered all the colour-control apparatus, the lighting of the theatre itself as controlled from the stage, and a demonstration of the electric and hydraulic stage bridges or lifts which enable differences in level in various parts of the stage to be arranged easily without special carpentering.

At the conclusion of the inspection Mr. Gaster, on behalf of the Society, thanked the Management of Drury Lane for giving such an interesting display, and the members adjourned to Magnet House.

After a brief interval for refreshments, the chair was taken by MR. H. C. PALMER, who explained that Mr. J. Y. Fletcher, who had hoped to be able to preside, was unavoidably absent.

MR. SETTLE, who was called upon to open the discussion, regretted that Mr. Basil Dean was unable to be present, but in his absence he made some general remarks on British and Continental practice in stage lighting, and showed how our methods were influenced by the actor-manager system in this country as compared with the freedom which existed on the Continent.

Some of the critics thought spectacular lighting was liable to distract attention from the dramatic action, and regarded special effects as a "stunt," but he emphasized that the Schwabe system was not only used for spectacular effect, but for ordinary stage lighting. Gasfilled lamps had revolutionized lighting by the ease with which their illumination could be graded. Dimmers have also been immensely improved of recent years. For revues, special set effects to surprise the public are aimed at, but he hoped that the Illuminating Engineering Society and the public would demand good stage lighting apart from "stunts."

MAJOR KLEIN believed there was a great future for colour-lighting as an independent art as well as in conjunction with dramatic art, but he pointed out that the very great cost of apparatus often proved a difficulty in experimental work to carry on development.

He had evolved an apparatus for projecting any coloured light or any combination. He referred to Mr. Thos. Wilfred's concerts of coloured light at Queen's Hall, and the projection of shapes and forms on coloured fields so as to give the effect of scenery. This might prove cheaper than actual scenery.

At present there is not sufficient knowledge of illumination technics among theatre lighting supervisors, who, although having great practical experience, very frequently had received no scientific training. Hence, there was a tendency to rely on empiricism and rule of thumb methods. A musical expert is usually engaged to advise on music, but no technically equipped specialist in lighting to deal with illuminating effects. If managers would only obtain the services of a well qualified illuminating engineer in an advisory capacity the possibilities were practically unlimited, but the speaker was doubtful of development until the financial position was more favourable. At present managers were apt to become discouraged as soon as they discovered that it was necessary to expend a considerable sum of money in order to obtain conditions realized in theatres abroad. He mentioned the projection of light through colour filters on to special pigments in a back scene, introduced by Mr. A. Samoroloff, which had already been tried and seen by the public at the London Hippodrome.

MR. P. SHERIDAN spoke of his experience of stage lighting years ago, and referred to the feeling among actors and managers that the public will come to see stage lighting and *not* the actors themselves if the former is made too attractive. He compared the practice of his early days, when coloured silk used to be stretched in front of open flame gas burners, with the marvellous control now possible in manipulating electric footlights, etc. Although lighting experts were very necessary they must always remember that they were only a unit in the army of specialists needed for a good production.

MR. R. ATHERTON referred to his efforts in putting forward projection type lamps and the necessity for adopting really well made lamps. He pointed out the similarity between the fields of stage lighting and shop window lighting so far as special reflectors were concerned.

MR. L. GASTER also pointed out the great opportunities arising from the use of new illuminants and new devices in the theatre, referring specially to the use of colour in contriving effects to supplement the efforts of the actor. He recalled the paper on "The Art of Stage Lighting," read before the Society in 1919 by Mr. J. B. Fagan, who, whilst endorsing the view that "the play's the thing," set a high value on effective lighting, and in his own productions had devoted special attention to the question, being a believer in the use of diffused light as illustrated in the Fortune "artificial firmament." The question of stage lighting was essentially one demanding the combined efforts of various experts, and the Society would make every effort to stimulate co-operation in this field.

In the course of further discussion in which MR. E. RIDLEY (London Fire Brigade), MR. WINSTANLEY, MR. L. E. BUCKELL, MR. L. G. APPLETREE and others took part, this need for co-operation was again emphasized, and it was pointed out that the services of an illuminating engineer in an advisory capacity would serve to supplement the work of the permanent electrical engineer, who had often considerable practical experience and showed resourcefulness with somewhat limited apparatus. A cordial vote of thanks to the General Electric Co. and to Mr. H. C. Palmer for presiding terminated an enjoyable evening.

Regulations Relating to Repair and Construction of Ships

A SERIES of draft regulations has been prepared by the Home Office, giving effect to the unanimous recommendations of the Departmental Committee appointed in 1923 to inquire into causes of accidents in shipbuilding and ship-repair, which it is proposed to substitute for existing regulations under Section 79 of the Factory and Workshop Act.

After summarizing various precautions desirable in the interests of safety, such as substantial construction and sufficient width of stages, protection of gangways, openings in decks, etc., a section is devoted to "Precautions against Injurious Fumes and Explosion." These relate mainly to places where acetylene is used for welding operations, etc., and to oil-carrying ships. Thus directions are given that acetylene generating plant or cylinders containing dissolved acetylene or compressed oxygen must not be installed or placed near a boiler, furnace or other source of heat; that each plant shall have attached to it a label bearing instructions for operation; that no person shall smoke or use a naked light or lamp other than a properly enclosed electric lamp in an acetylene generator house; that, wherever practicable, the charging and cleaning of acetylene generators shall be done during light. Partially spent carbide is not to be recharged into a generator.

Similarly no naked lights, fires or lamps, other than properly enclosed electric lamps, and no apparatus of any kind for producing a light or spark shall be permitted on any oil-carrying ship, except in such places as are specially authorized for the purpose, until a certificate of test has been obtained in respect of each oil-tank. When work is being carried out on any oil-tank (a) no other than suitably enclosed safety electric lamps shall be used, and (b) no rivet or other fires, or and no naked lights shall be taken into the tank, and, wherever practicable, heated rivets shall be passed through tubes. Special precautions against possible injuries from falling materials are next suggested.

Under the heading "Electricity and Lighting" the following recommendations are made:—

"44.—Direct current only shall be used, and the pressure shall not exceed 120 volts (a) for all temporary electric installations for lighting or heating at a ship under construction or repair; (b) for welding by means of an electric arc, except where it can be shown that the use of alternating current is equally as safe as that of direct current at a pressure of 120 volts.

"45.—(a) All parts of a ship where work is being carried on shall be efficiently lighted; (b) all approaches to such parts and to places to which a person employed may be required to proceed in the course of his employment shall be adequately lighted, and in particular lights shall be provided at all deck and other dangerous openings, and at all ladders and gangways. If portable lamps, including hand lamps carried by the workmen, are used for any part of such lighting, they shall be maintained in good condition. Oil lamps shall be provided with properly fitting screw lids or stoppers, and be so constructed as to prevent, so far as practicable, the development of leaks.

"46.—Oil or spirit with a flashpoint below 73° F. shall not be used for purposes of lighting."

It is prescribed that, for all persons engaged in using acetylene burners or blowpipes, adequate protection shall be provided for the hands and suitable goggles fitted with tinted glass eyepieces shall be provided.

Other recommendations deal with Training and Supervision, Ambulances and Duties of Persons Employed. As regards Section (45), no doubt the requirements of "adequate lighting" will be defined in due course, as has already been done for factories. Some useful hints on this point were given in the report of the Admiralty Electric Lighting Committee, commented on in our June issue (p. 146).

Meteorological Office (Air Ministry)

Tenth Report of the Committee for the Investigation of Atmospheric Air-Pollution

THE above report, now available, contains a considerable amount of useful information. It is particularly timely in view of the close relation between smoke abatement and the value of sunlight in the interests of health, discussed at the meeting of the Illuminating Engineering Society on June 9th. (See pp. 179-184.)

The present report marks the completion of twelve years of activity of the committee. During all this time tests on the causes and nature of air pollution have been proceeding, and valuable records of impurities in the air have been obtained by the standard deposit gauge, and the automatic filter, which measures hourly the amount of suspended matter; similarly another instrument, the "jet dust counter," enables a microscopic examination of dust particles and their number to be made.

The report contains many interesting records of conditions during fogs, and an instructive diagram is included, showing the effect on the load-curve of an electrical supply company. This, in itself, shows the economic loss arising from fogs and air pollution, obscuring the light of the sun and rendering artificial light necessary. A description is also given of a new instrument due to the ingenuity of Dr. Owens, the "settlement dust counter," specially useful in dealing with air containing very coarse particles (e.g., in grain warehouses, etc.). On the whole, it appears that the air during 1924 was not as pure as in the previous year, so that there is every reason for those interested in the movement for eliminating pollution to renew their efforts.

Of special interest is the account of the experimental work being done with the object of determining the extent to which impurities in the air diminish the intensity of sunlight. Quite apart from the injury to health arising from the blockage of the sun's rays (especially those in the ultra-violet, which are particularly easily checked by smoke) the economic value of this loss of light throughout the British Isles must be considerable. It would be most valuable if an estimate of this loss, backed by scientific data, could be presented. In this aspect the Illuminating Engineering Society has taken a special interest, and is represented on the Technical Sub-Committee by Professor McGregor Morris, whilst Mr. J. W. T. Walsh (N.P.L.) is also a member. By experiments with illumination photometers and contrast photometers the percentage of light transmitted by 50 feet of air has been determined under various conditions, values ranging from 77 to nearly 100 per cent. being obtained. This in itself gives some indication of the losses that must ensue when light passes through a considerable depth of smoky atmosphere. Attempts are being made to relate the loss to the number of solid particles in suspension. In the United States observations from aeroplanes appear to be proving useful in the study of these problems.

POPULAR & TRADE SECTION

COMPRISING

Installation Topics—Hygiene and Safety—Data for Contractors—Hints to Consumers

(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society; and is based on outside contributions.)

Some Notes on Electric Lamps

No. 7

THE PROJECTOR LAMP

By W. J. JONES, B.Sc., A.M.I.E.E.

(E.L.M.A. Lighting Service Bureau).

THE optical projection of light invariably involves a light source of small dimensions and of high intrinsic brilliancy, and it was for this reason that the electric arc found so much favour. Indeed, even at the present day, in cinemas where a long throw is necessary the electric arc still holds sway. All who have had experience of the electric arc are familiar with its limitations and the amount of attention which it requires in order to give satisfactory results. Any innovation, therefore, that will give a stable light and does not require constant trimming or adjustment finds much favour. Hence, it is not surprising to find that

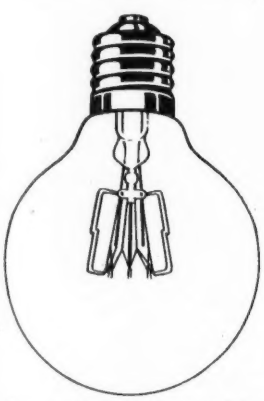


FIG. 1.—Type of lamp used for flood-lighting.

there are many uses of the gasfilled lamp in the projection of light on account of its freedom from flickering and its high intrinsic brilliancy.

Unfortunately for the accurate control of light, the filament dimensions of the ordinary gasfilled lamp are unsuitable, and attention has been given to the problem of concentrating the filament into a still smaller space. Another obstacle hindering the wider use of these lamps (one of the difficulties which prevents them from being utilized as much as is desirable) is the fact that when operating on a high voltage there is a tendency for a thermionic arc to be produced so that the filament must, of necessity, under such conditions in high voltage lamps be reasonably well spaced. This is one of the reasons why the high voltage lamps are not quite so efficient for optical projection as low voltage lamps. Lamp manufacturers have dealt with this problem in two ways:—

(1) By increasing the intrinsic brilliancy of the gasfilled lamp by operating it at a higher efficiency (this also means a reduction in life).

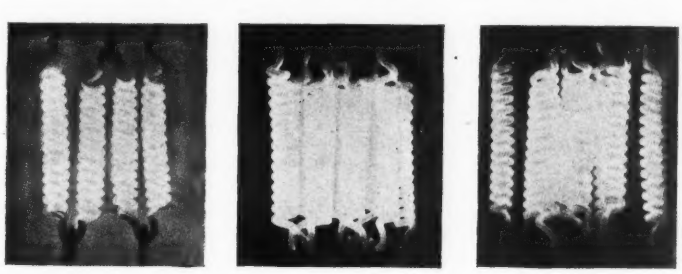
(2) By special filament mounting to ensure the necessary concentration.

The majority of people are quite willing to sacrifice a somewhat shorter life of lamp if an increase in brilliancy can be obtained. In practice projector lamps are made in two main types:—

(a) Those for use in flood-lights where such accurate control of the light is generally unnecessary.

(b) Those for use in optical lanterns where the maximum control of light is required.

Fig. 1 shows the type of lamp which is employed for flood-lighting purposes. It is important in such instances to ensure that the lamp operates in a vertical position, or in the position recommended by the manufacturer. For use in projection lanterns and cinematograph apparatus a closer formation of filament is desirable, and a lamp is available in a tubular bulb, the filament of which takes the form of a grid.



A B C

FIG. 2.—Photographs of grid filament showing image from mirror, (A) simple filament, (B) filament and image coinciding, (C) filament and image in incorrect adjustment.

In (A) Fig. 2 is seen one formation of grid filament. It will be realized that in use a considerable improvement in the efficiency of the optical system can be obtained by means of a spherical mirror behind the lamp, in order to use a greater proportion of the total light flux that is emitted. This mirror has the effect of producing an image in the proximity of the filament itself, and (B) Fig. 2 shows the correct meshing of filament and image; it forms an almost complete block of light. (C) Fig. 2 shows the filament and image incorrectly meshed. Nowadays gasfilled projector lamps are available in many types and sizes suitable for all purposes.

Illuminated Signs

DURING the past few years the employment of illuminated signs has increased enormously. Few things, perhaps, in the world of publicity have developed so fast. The attractive power of a bright object amid darkness is now fully realized by the advertiser who, in consequence, is willing to incur heavy expenses in order to employ this new instrument to good advantage. Colour, movement, design and originality of conception are all at his command—if his pocket be deep enough.

Hitherto, one of the great disadvantages of illuminated signs has been that, although many are effective by night, few show up well during the daytime. This means, of course, that such signs are "dead" for half the term of their existence. Among the numerous attempts to overcome this undesirable state of things, one of the most satisfactory yet exhibited is that illustrated below. Fig. 1 illustrates the construction of this type of sign. As will be seen, it consists of a trough, shaped according to the letter and containing the electric lamps. Fitted to this is a domed face of somewhat smaller dimensions, thus leaving a margin through which the reflected light passes outwards. The lamps themselves are completely hidden by the domed face, and variety of colour may be had by choosing a suitably coloured letter-trough. For purposes of cleaning and repairs the face can be withdrawn as shown in the illustration. The plunger (swivel F) prevents the face from becoming totally detached, and at the same time allows it to be swung clear of the trough. At G and H are catches which engage springs under the face when this is shut down and hold it rigidly in position.

The lamps used in this sign are clear 20, 30 or even 60 watt lamps, according to the range and intensity desired. That this type of lettering is effective both by day and night is evident in Figs. 2, 3 and 4.

Fig. 3 illustrates the sign as it appears in daylight—a bold, clean piece of work, vigorous and arresting. The next picture shows the same sign by night. Every stroke of light in the outline tells, and tells at once. The mind is bitten, as it were, by their sharpness. The thing behind the sign—the thing advertised—goes straight to the memory in a complete and convincing manner without the sign obtruding itself upon one's notice and thereby blurring the "idea" of the advertisement. Such a sign drives its "idea" straight home to the mind of the observer. This will be seen even better in Fig. 2, where the words *Sunday Times* become strangely familiar almost at first glance.

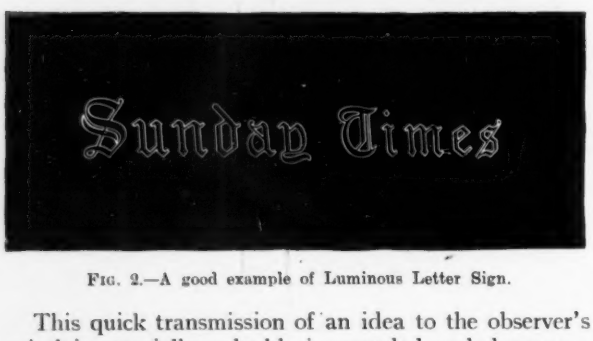


FIG. 2.—A good example of Luminous Letter Sign.

This quick transmission of an idea to the observer's mind is especially valuable in crowded and dangerous thoroughfares where people have all their attention absorbed in dodging traffic. To the harassed pedestrian the very stillness of the lights is restful, with the result that he responds with something like gratitude to the dignified appeal, and probably retains the image long after the other impressions have faded away in confusion.

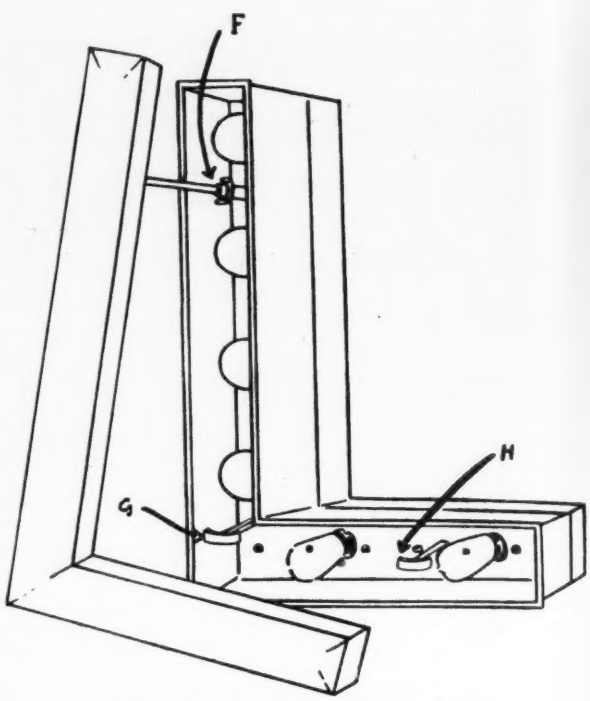


FIG. 1.—Construction of Modern Letter Sign.

By day, too, the letters have a distinctive appearance, and are easily read from a distance, so that they may be kept constantly on active service throughout the twenty-four hours.

It is not, of course, intended to suggest that animated signs are ineffectual, for evidently such is not the case. Nevertheless, there does seem to be a wide field for the type of sign just described, not only on account of its efficiency, but also as a contrast to the signs where movement and colour constitute the chief attraction.

Pageant and Spectacular Lighting

A survey of recent developments in pageant and spectacular lighting was given by Mr. D. W. Atwater at a recent joint meeting of the Illuminating Engineering Society (U.S.A.), Chicago Section, and the corresponding section of the Western Society of Engineers. In America conventions and "world's fairs" afford the chief opportunities for spectacular lighting. It is not generally realized how many of these are held each year (some engineers are apt to think that they happen too often!). Thus it was stated that in the city of Portland, Oregon, alone there will be between twenty and thirty conventions this summer. At one of these conventions it is proposed to spend 80,000 dollars simply for night illumination.

Mr. Atwater referred to some of the difficulties of lighting engineers in dealing with such events. The Chairman of the Convention will usually appoint a Lighting Committee or a Decorations Committee, and these gentlemen have usually little or no technical knowledge of illumination. They never seem to realize that it takes time to get lighting devices ready, and do not begin to make preparations until a few months before the convention. One committee may work on day decorations, another on night decorations—possibly neither knowing what the other is doing!

This illustrates the difficulties of the work. However, Mr. Atwater was able, apparently, to show slides of some unusual and ingenious effects, notably the production of an "aurora" on the Washington Arch at the Democratic Convention held in New York last June.

FIG. 3.—Appearance of sign by day

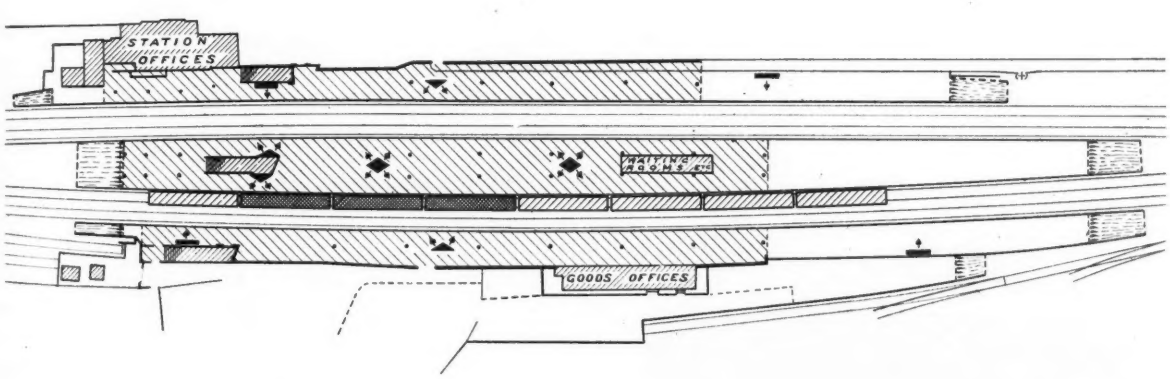
FIG. 4.—Appearance of sign by night.

The Illumination of Station Name-Plates

SOME illustrations of recent developments in connection with illuminated name-plates for stations were described in the recent lecture at the Polytechnic on "Railway Lighting" by Mr. A. Cunnington (Lighting Engineer to the Southern Railway).

An experiment was recently carried out on the Southern Railway in the direction of using illuminated box signs for this purpose. In providing these signs it was recognized that the cost must be kept within a reasonable figure, and therefore the number of the signs had to be as limited as possible. This led to the adoption of the diamond shape as being most suitable for displaying the name in all directions. The idea is that wherever a train pulls up at the various platforms and wherever a passenger may be sitting, there is certain to be an illuminated name visible, either on the platform at which the train is standing or viewed on one of the other platforms across the lines. A glance at the illustration herewith, on which the various faces of the signs have been indicated by small arrows, will show that for a train of eight coaches standing as illustrated there will be fourteen illuminated names visible in one direction or another. Even for a short train of three coaches only, the position of which is indicated by cross-hatching, there would be ten names giving useful indication. The only difficulty in adopting such a scheme as this for general use is that it would be rather costly, and it could therefore only be used on stations of some importance. For smaller stations name tablets on each lamp, illuminated externally by the existing platform lighting, are thought to be the most satisfactory means of displaying the station name. The diamond-shaped signs referred to above were manufactured by the London Sand-Blast and Decorative Glass Works Co., who have patented the design.

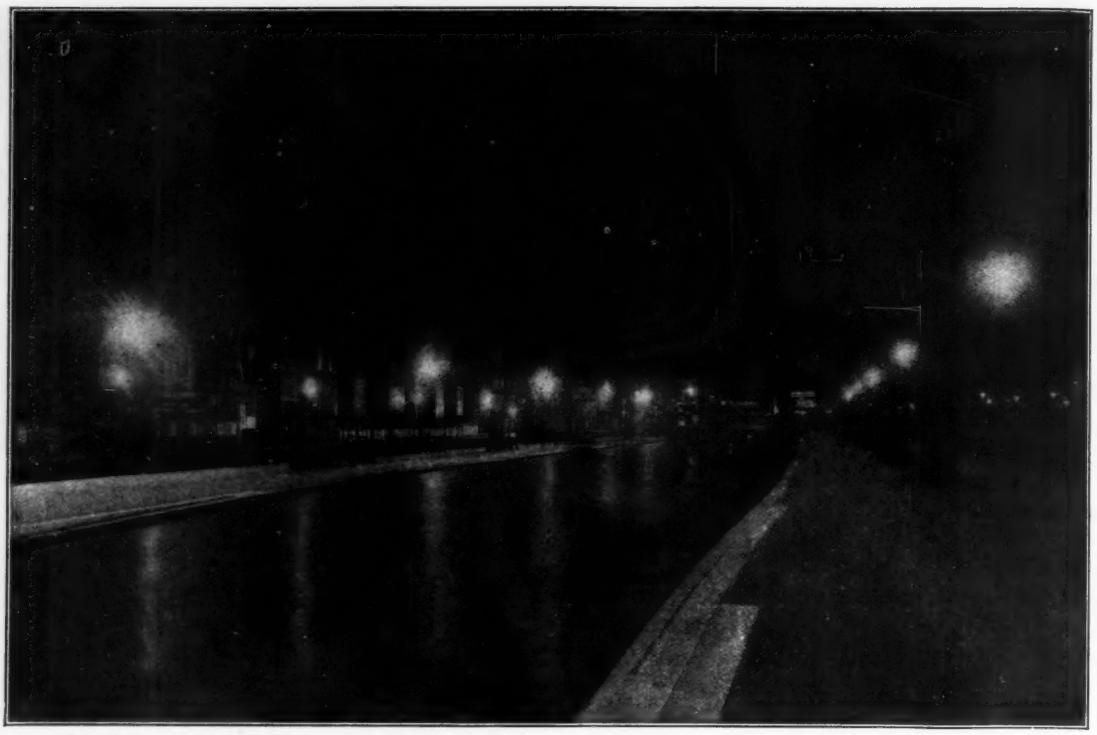
A good feature of the system is that it is generally applicable to widely different types of stations, and it could also be applied both with gas and electric lighting. The development of this idea will be watched with interest.



London Bridge Centenary

It is interesting to recall that June 15th was the centenary of the laying of the foundation stone of "new" London Bridge, from the designs of Mr. John Rennie. On that famous Fifteenth of June, *The Morning Post* remarks, London made a day of it. After the ceremony visitors were entertained at the Mansion House, "the whole edifice being brilliantly illuminated within and without." The Monument was also "superbly illuminated with Portable Gas," a lamp being placed at each loophole of the column to give the idea of its being wreathed in flame. Two other series were placed on the edges of the gallery, "though the wind seldom permitted the whole of the gas to remain lighted at the same instant."

It is remarkable how consistent our forefathers were in marking each event by appropriate "illuminations," in spite of the fact that their facilities were so much more primitive than those available to-day.



The Victoria Station of the Southern Railway (Brighton Section) is lighted by 431 high-pressure incandescent gas lamps of a total candle-power of 125,000. These lamps were fixed in the new station after it had been found that the substitution of gas lighting for an obsolete system of lighting in the old station had brought about a reduction of over £1,100 a year in the lighting bill.

The Lighting of Victoria Station

THE Victoria Station of the Southern Railway Company (Brighton Section) is one of London's busiest terminus stations. The Brighton line is used by thousands as their daily route to business as well as by crowds of people travelling to or from the Continent or the South Coast.

In its equipment the station is one of the most up-to-date in the whole country. The manner in which it is lighted is therefore of great interest. It is a question which received very careful consideration on the part of the directors and engineer of the Railway Company when the new station was erected a few years ago. They ultimately decided to adopt gas. Even before the station had been reconstructed and modernized the Company effected a saving of no less than £1,100 per annum (in addition to obtaining greatly improved illumination) by substituting gas lamps for an obsolete lighting scheme.

Photograph taken behind the signals in order to show one of the high-pressure gas lamps with special shade reflectors used for illuminating the signals.

The station is now lighted by 431 high-pressure inverted incandescent gas lamps varying from 90 to 1,000 candle-power and giving a total light of about 125,000 candle-power. Gas is supplied to the lamps at a pressure of about 54 inches from the high-pressure main of the gas undertaking, and is registered through three 200-light cylindrical meters specially constructed to withstand the pressure.

The lamps for the lighting of the platforms are of 500 and 300 candle-power and are placed one between each pair of columns carrying the roof, so that there is an entire absence of shadow. The distance between the lamps is about 50 feet, measured along the platform, and the lamps are hung so that the burners are about 12 feet from the platform level. By this arrangement the light is very evenly diffused, fully sufficient in every part and very effective without being in the least staring to the eye.

The platforms are divided into sections by the Eccleston and Elizabeth Bridges, under which they pass. Suspension lamps are used for lighting the platforms beneath the Eccleston Bridge, and back lanterns for lighting them beneath the Elizabeth Bridge.

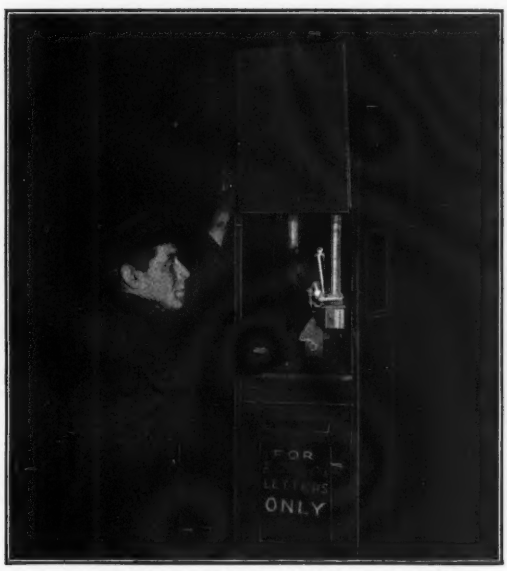
Distance Control Arrangements.

The lamps lighting each of the platform sections are controlled by two taps (specially devised for the purpose) placed at the end of the section, one tap controlling lamps 1, 3, 5, etc., and the other controlling lamps 2, 4, 6, and so on. In this way every alternate lamp can be lighted or extinguished in series from the control point. The station authorities can therefore easily reduce the consumption of gas by one-half when any portion of the station is not actually being used for traffic, without putting any part of the platform entirely in the dark. To enable this to be done, two lines of gas pipes are installed, with a third independent pipe to supply the bypasses in the lamps. A special cup-and-ball joint is used for connecting the down-rod of each lamp to one of the two main supplies and to the bypass service, the one cup-and-ball serving for the two connections (namely, to the main and bypass pipes). Each lamp, too, is connected by a cup-and-ball to the down-rod supplying it so that the effects of vibration on the mantles are reduced to a minimum.

A special mercurial seal is fitted to each down-rod to prevent air entering the pipes when the gas is shut off by the distant control tap. The down-rod is also fitted with a tap to enable any lamp to be easily removed without shutting off the supply to other lamps.

Each section of the bypass services is fitted with a governor, which reduces the pressure in the service to two inches. The bypasses are completely extinguished by the action of lighting the lamps and are automatically lighted again when the lamps are turned out.

The station yard beyond the platforms is lighted by six 1,000 candle-power lamps on weldless steel columns. These lamps are lighted and extinguished by distance control taps at the base of the columns to avoid the necessity of climbing the ladder to light or extinguish the lamps.



The lamps on each platform section are controlled by two taps, one turning on or off lamps 1, 3, 5, etc., and the other lamps 2, 4, 6, and so on. In this way alternate lamps can be lighted or extinguished in series from the control point.

Signal Lighting.

The signals are illuminated by high-pressure gas lamps suitably placed. The railway lines immediately beyond the station yard and for a short distance beyond the exits are lighted by low-pressure inverted gas lamps. These lamps are supplied from the high-pressure services through double governors, an arrangement which prevented the necessity and expense of running special low-pressure gas supplies. The services for the signals and column lights in the yard have been laid in pitch in wood troughing.

The whole scheme for the lighting of the station, as approved by the engineer to the Railway Company, was prepared by the local gas undertaking, to whom the work of installation was entrusted.

View of some of the gas-lighted platforms in Victoria Station. A special cup-and-ball joint is used for connecting the down-rod of each lamp to one of the two main supplies and to the bypass service, the one cup-and-ball serving for the two connections (namely, to the main and bypass pipes). Each lamp, too, is connected by a cup-and-ball to the down-rod supplying it, so that the effects of vibration are reduced to a minimum.

Natural and Artificial Sunlight in Health and Disease

Exhibits at the Meeting of the Illuminating Engineering Society on June 9th, 1925

AT a meeting of the Illuminating Engineering Society devoted to a discussion on the above subject, on June 9th, 1925, there were a number of interesting exhibits, illustrating recent developments in this field.

Exhibit of Messrs. Watson & Sons (Electro-Medical), Ltd.

The artificial sources of ultra-violet radiation can be broadly classified into three types, the tungsten, carbon and mercury vapour arc, and of each of these the firm of Watson & Sons (Electro-Medical), Ltd., were showing an efficient example, namely:—

(1) Hall tungsten lamp, which burns swaged tungsten rods, and can be supplied with a resistance mounted on the base, thus forming a self-contained unit, or with separate control panel, as illustrated, in which A indicates paired tungsten electrodes; B paired milled heads for fine adjustment of feeding mechanism; C mirror, interchangeable with shield, D; E splutter bowl; F G H mechanical adjustments of lamp as a whole, height, rotation and tilt respectively. (See Fig. 1.)

(2) A mercury vapour lamp of the atmospheric pattern, which is not only more efficient but less fragile in transport than the vacuum form. The lamp here shown on floor standard can be supplied fitted for suspension and either pattern, with additional lamps to heat the body during irradiation, as this type of lamp is deficient in infra-red or heat rays.

(3) A highly efficient flame arc, burning ordinary or cored carbons, specially designed for ultra-violet light therapy, as the result of research work carried out at the New End Hospital, under the direction of the National Institute of Medical Research. The illustration shows the entire lamp, the upper mechanism of which is fitted with a cover (not shown) when in use, and also an enlarged view of the carbon holders.

All the above are suitable for general irradiation; the first and last for local application to the surface of the body when fitted with suitable limiting diaphragms. A modification of the last, water-cooled and fitted with quartz applicators, can be supplied for treatment of the body cavities.

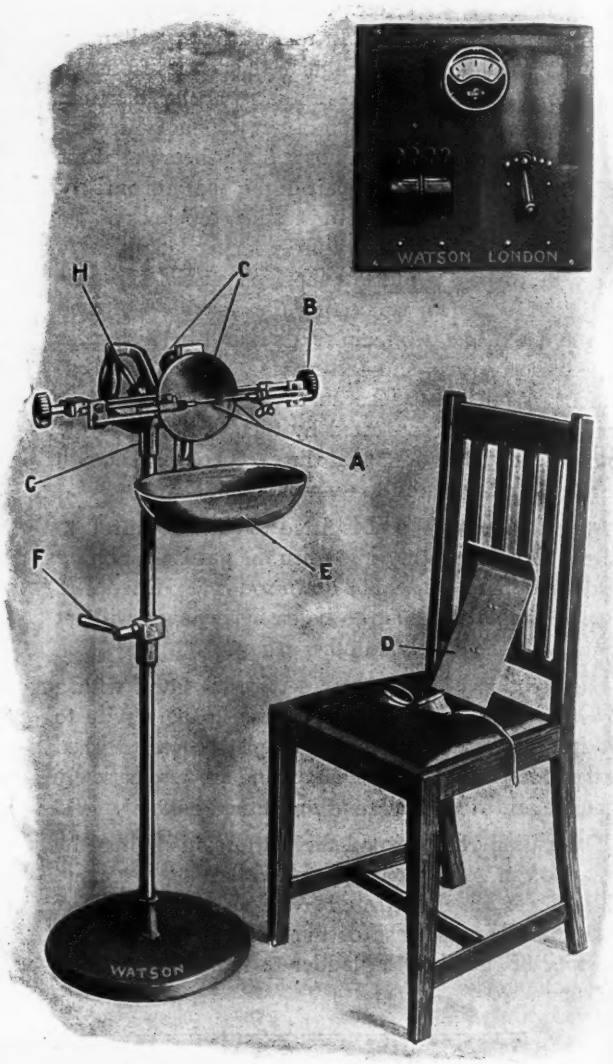
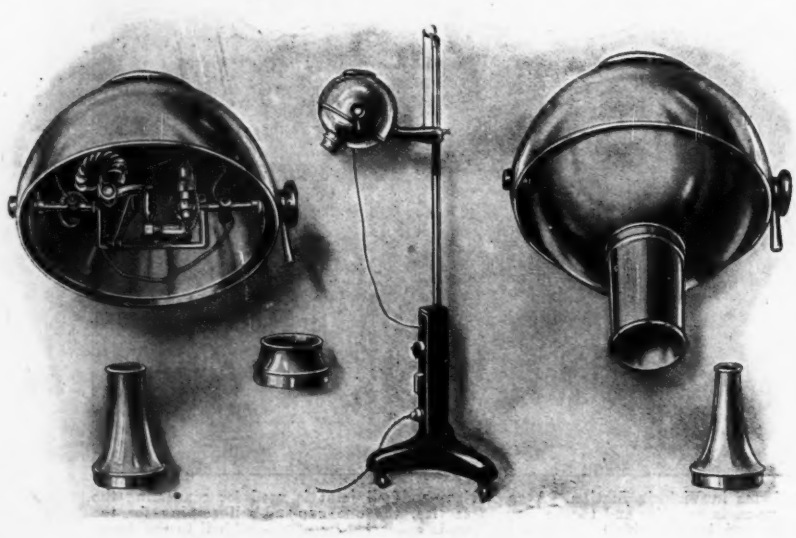


Fig. 1.—Hall Tungsten Lamp.



These three lamps were exhibited as typical of modern forms, illustrating the most interesting developments during recent years. We understand, however, that many other forms are supplied, furnishing other varieties of radiation, for example, for heat treatment, etc.

Fig. 2.—Showing Mercury Vapour Lamp of the atmospheric pattern, which is not only more efficient, but less fragile in transport than the vacuum form. The lamp is here shown as a floor standard.

Artificial Silk Permeable to Ultra-Violet Rays.

An interesting exhibit, displayed by Dr. Saleeby in the course of his lecture, may here be mentioned, namely garments of artificial silk, light in texture and suitable for wear in sunny weather. White fabrics, having fine apertures, allow a certain amount of light to penetrate to the skin, and apparently the maximum beneficial effect is obtained with artificial silk, which is stated to be particularly permeable to ultra-violet rays.

Exhibit of Messrs. X-Rays, Ltd.

The arc shown by Messrs. X-Rays, Ltd., is of the open type, two being usually run in series, operating at about 25 amperes. The stroke is about 1½ inches, so as to allow up to 120 volts across the lamp. The lamps are automatic, and can be arranged either for alternating or direct current, or for series or parallel working simply by altering the solenoid (only a series coil being used). We understand that the firm also makes a pure tungsten arc and various other lamps for sunlight treatment.

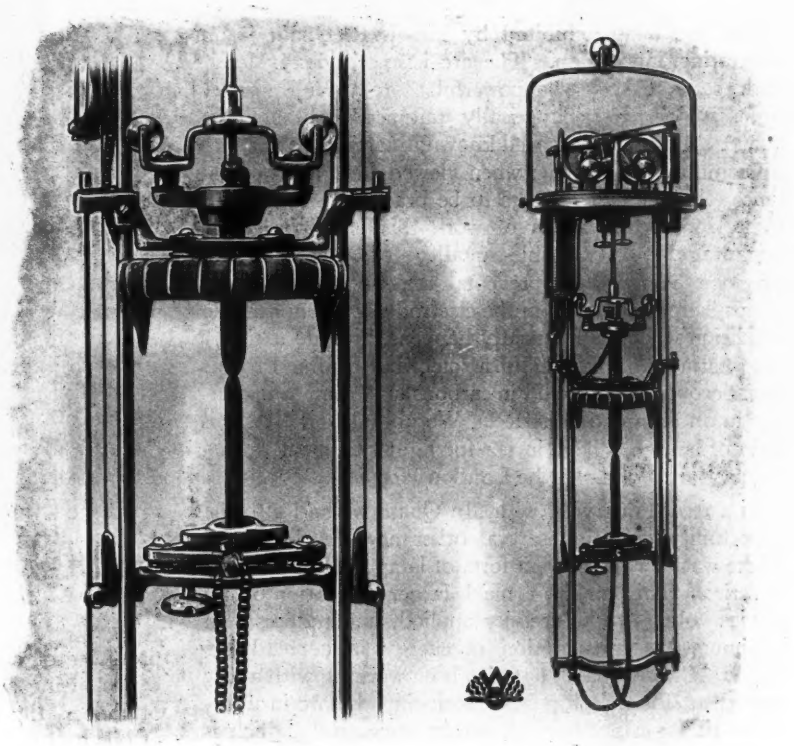


Fig. 3.—Efficient form of Flame Arc, burning either ordinary or cored carbons, specially designed for ultra-violet light therapy. An enlarged view of carbon holders is also shown. [Exhibited by Messrs. Watson & Sons (Electro-Medicine), Ltd.].

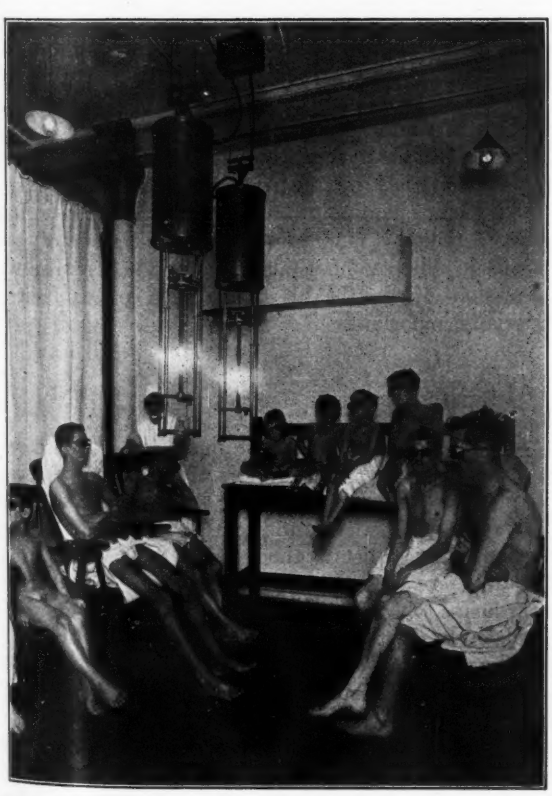


Fig. 4.—Showing patients undergoing treatment with the Westminster Sun-Ray Arc Lamp at a London hospital.

The Westminster Sun-Ray Arc Lamp.

The "Westminster" Sun-Ray Arc Lamp, exhibited by Mr. A. G. Way, of the Westminster Engineering Co., Ltd., was stated to be in use at many of the hospitals referred to by Dr. Saleeby. The standard pattern takes 30 amperes, but smaller sizes for private practitioners are also used. The length of arc can be varied from two inches or more, depending on the voltage, to a short arc for the "Finsen" treatment, and the intensity of ultra-violet light can be also controlled by the use of different electrodes. White-flame electrodes with a long arc give excellent therapeutic results and a light rich in rays just below the visible spectrum. With tungsten-cored electrodes, which burn smoothly and without spluttering in the lamps, the shorter rays are emphasized—down to 2,100 A.U. Various spectra, taken by Dr. Judd Lewis, were on view.

Mr. Way added that it was found that the "Westminster" lamp gave practically the same therapeutic results on alternating current as on direct current, and no converter or motor-generator was required for an alternating supply. This was somewhat remarkable, as with process engraving and ordinary photography the efficiency on alternating current was only about two-thirds. At one hospital in London, situated near the Thames, and where the atmosphere was never free from pollution, the lamps were used in preference to outdoor sunlight, even in the height of summer.

The accompanying illustration shows a group of patients at a London hospital undergoing treatment with one of these lamps.

Exhibit by Mr. J. R. Quain.

The arc lamp exhibited by Mr. J. R. Quain is an interesting innovation. The arc is exceptionally long, and therefore acts as a powerful source of ultra-violet light, which passes practically unimpeded through the quartz cylinder. As is well known, quartz has a distinct diffusing effect, so that, when viewed from a little distance, the cylinder appears to be practically filled with light; for certain forms of work this is doubtless an advantage. A valuable quality of the enclosing envelope is that it prevents the escape into the atmosphere of fumes from the electrodes—an undesirable condition when, as frequently happens, arcs are used for the treatment of patients in a somewhat confined room. Great economy is effected in carbons, as the arc is operating in an oxygen-free space. We understand that this form of lamp has been in use for light treatment during the past six months at the London Hospital.

In a recent interview with Mr. Quain we had also the opportunity of seeing several other new developments. There was, for instance, a form of lamp having two arcs in series. This enables a much larger proportion of the service voltage to be usefully applied, and reduces to a minimum the consumption of energy in a steadying resistance. Mr. Quain has also been working with a new ingredient for the purpose of enriching the arc in ultra-violet light—a mixture of certain rare metals which is considerably cheaper than tungsten, but appears to be equally effective. A comparison of photographs of the spectra of the tungsten arc and an arc struck between electrodes of this new composition shows that the region most valuable for general therapeutic treatment is common to both. This special mixture may be introduced into carbons in the form of thin wires. It is also possible to maintain an arc between electrodes composed solely of this material. An ingenious device—again used with the object of eliminating waste of the supply voltage—is the use of a central pencil between two horizontal electrodes, so that two arcs in series may be formed. In the process of burning, some slag forms on the electrodes, solidifying when they are cool. This may occasion a little more care in starting up, but has the advantage of protecting the incandescent surface, so that fumes are largely eliminated and the life of electrode prolonged.

Mr. Quain is well known as one responsible for much original work with fused quartz and special glasses permeable to ultra-violet rays. On the occasion of our visit we were shown several early lamps of considerable historic interest, for instance, bobbins of tungsten mounted direct on the quartz, which was allowed to become incandescent—a device adopted in the days (from 1911 to 1913) when tungsten was much more brittle and fragile than at present. There were also early forms of focus lamps, using helices of tungsten wire. The idea of utilizing the permeance of quartz to ultra-violet light, and to the rays excited by a discharge in a closed vessel, is again illustrated in the well-known Quain system for producing ozone. Whilst somewhat removed from ordinary manifestations of light and ultra-violet rays, the production of ozone in this way is of considerable scientific as well as practical importance. Ozone has many applications, for the removal of unpleasant smells and the alleviation of a fœtid atmosphere; as a purifier of air and water; and as a sterilizer and healing agent, having been applied for the treatment of septic wounds, tuberculosis, and many other diseases. Ozone likewise plays an important part, either as a disinfectant or as a promoter of chemical action, in many industrial processes, being applied in such processes as the seasoning of timber, the hardening of varnishes, the sterilization of oils and fats, and the prevention of fungoid growths in tobacco warehouses, cold-storage plants, etc.

Fig. 5.—General View of Quain Quartz Arc.

Lamplough's "Vitaglass."

Mr. F. E. Lamplough had on exhibition some specimens of "Vitaglass" evolved by him as a result of long-standing experiments. The glass is stated to contain a high proportion of quartz, and also certain ingredients absent from ordinary window glass. A comparison of the spectrum of an unscreened iron arc, and the same light after transmission through ordinary window glass shows that in the latter case all rays beyond about 310$\mu\mu$ are cut off. With the "Vitaglass," on the other hand, although the rays in the extreme ultra-violet are still obstructed, those in the region of from 290 to 310$\mu\mu$, which are regarded as most valuable from the hygienic standpoint, are still transmitted. It is believed that this new form of glass will prove of great benefit in schools, hospitals, sanatoria, etc., where the admission of the health-giving rays of sunlight is especially important.

British Electric Transformer Co., Ltd.

The British Electric Transformer Co., Ltd., showed an interesting series of radiators of various types, some of distinctly ornamental form. These radiators utilize light from gasfilled incandescent electric lamps, so that the radiation consists both of visible light and of a considerable proportion of heat rays. Whilst thus differing from lamps which are intended to produce mainly rays of relatively short wavelength, these radiating units have useful applications also for many forms of medical treatment. We understand that exposure to this form of radiation has proved very beneficial in accelerating plant growth, and their properties illustrate the importance of recognizing the wide range of the sun's spectrum and discriminating between the effect of different wavelengths.

Exhibit of the Medical Supply Association, Ltd.

The exhibit of the Medical Supply Association included three main forms of lamps for producing ultra-violet rays. Dr. Hall's lamp (an example of which is already illustrated on p. 192), the type of mercury-vapour lamp illustrated in Fig. 1, and the special ultra-violet lamp shown in Fig. 2.

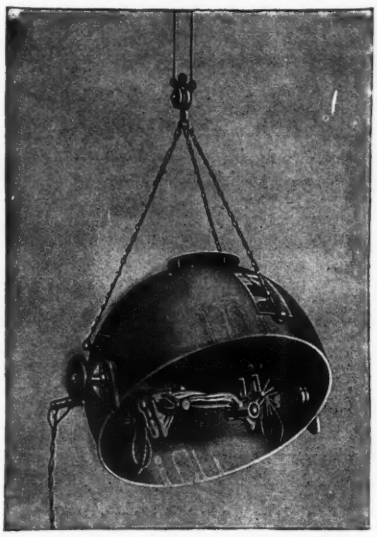


Fig. 1.—Convenient Form of Mercury-Vapour Lamp.

The mercury-vapour lamp is of the quartz tube type, and is conveniently mounted on chains so that the lamp can be tilted so as to get the light at any desired angle. The form of lamp shown in Fig. 2 utilizes tungsten electrodes, and the light, focussed through a quartz lens, is regarded by some authorities as that richest in ultra-violet radiation. Tanning of the skin is very readily produced by this form of radiation. This apparatus can only be used on a direct-current supply; with alternating current a motor transformer is necessary.

The firm also supplies many forms of lamps concentrating light from incandescent lamps, used with or without coloured screens, and directing on the patient radiation consisting both of visible light and heat. It will be seen, therefore, that these varieties of lamps alone furnish quite a wide range of radiation, and it is evident that medical advice is very necessary in order to decide which form is suitable for any individual case.

Fig. 2.—Special Form of Tungsten Arc.

Light and Health

At the District Conference of the British Commercial Gas Association, held in Harrogate last month, Dr. R. Veitch Clark, Medical Officer of Health for Manchester, gave an address on the above subject, in the course of which he emphasized the importance of sunlight to health, and stigmatized the smoke pall over industrial cities as a disgrace. The breathing in of a smoky atmosphere was undoubtedly prejudicial to health; but even more important was the exclusion of the beneficial sunlight, and its constituent ultra-violet rays. Dr. Veitch described the sunlight treatment of tuberculosis in Switzerland, and at a sanatorium under his own charge in North Wales. Ages ago people worshipped the sun for its health-giving properties; yet to-day, by our own folly, we shut it out. We had to go to holiday places to get the sun, which we could get at home if we did not burn raw coal.

The Gas Meter and Household Economy

The results of a popular competition, comprising an essay on the above subject, and arranged by the British Commercial Gas Association for children of 10-16 years of age, have recently been announced. The prizes include the award of two £50 scholarships, and the standard attained in the essays, many of them by children in elementary schools, is said to have come as a pleasant surprise to the judges. The special committee who made the final scholarship awards consisted of the Hon. Sir John Cockburn, Dr. Lydie M. Henry, of King's College for Women, and Dr. Percy Schofield, Principal of Loughborough Technical College. There is no doubt that such competitions may have a valuable educational effect, and we hope that children will thus be encouraged to study the benefits of good lighting.

Illuminating Engineers and Medical Research

Another timely reminder of the need for co-operation between experts on light and optics and medical investigators was given by Mr. L. Gaster, Hon. Secretary of the Illuminating Engineering Society, in an interview granted to a representative of the *Morning Post*.* Mr. Gaster, whilst disclaiming any detailed knowledge of the recently announced discoveries in connection with cancer, mentioned several instances in which a knowledge of light and optics had proved extremely useful to the medical profession. A good example is the ultra-microscope, as ordinarily understood, which depends on the observation of a solution illuminated by a very powerful beam of light, such that objects too minute to be otherwise detected are recognized as points of light, and their motions can be studied. However, the resolving power of the microscope can be still further extended by the use of ultra-violet light and the substitution of a photographic plate for the eye. It is understood that this method has proved very effective in some forms of medical research, and on p. 176 some account is given of the methods used by Mr. Barnard in his research on cancer.

Royal Photographic Society
Forthcoming Annual Exhibition

The seventieth annual exhibition of the Royal Photographic Society is to be held during September 14th to October 24th, and contributions are now invited. There are eight sections (natural history subjects, photomicrographs, radiographs, astronomical and spectrum photographs, stereoscopic work, scientific colour work, technical applications of photography, and kinematography). Full particulars may be obtained from the Secretary, 35, Russell Square, London, W.C.

* July 15th, 1925.

The International Illumination Commission

Its Importance to the Gas Industry

AT the annual meeting of the Institution of Gas Engineers, which took place last month, a very comprehensive report on the sixth session of the International Illumination Commission, held in Geneva last year, was presented by Mr. Watson and Mr. Dunn (Secretary of the Institution of Gas Engineers).

Attention was drawn to the representative character of the gathering; also to the tendency for the Commission to be more occupied with practical aspects of illumination. Thus great interest was taken in the papers by Dr. W. Lieb and Mr. A. L. Powell from the United States, describing propaganda in favour of better lighting. These methods, Mr. Watson pointed out, are common to both gas and electrical supply undertakings in the United States, and he emphasized the importance of this form of work being actively developed in this country.

Mr. Watson also alluded to the work being now undertaken by the sub-committee, working under the British Engineering Standards Association, on street lighting. There was an impression that the gas industry was not taking sufficient interest in the lighting field. He himself believed that in Great Britain, at any rate, gas companies still looked upon lighting as an important part of their business. He believed that there was still a considerable future for gas lighting, and there were many firms that were busily occupied in making fittings.

He earnestly hoped that the Institution would retain its interest in this work, whatever might happen in other countries. It should be remembered that the Commission was originally started by the gas interests at an International Meeting in Paris (the International Photometric Commission, out of which the International Illumination Commission has developed).

The President assured Mr. Watson that the Institution would maintain its interest in illumination with gas. In considering other countries, such as Switzerland, it was necessary to remember how greatly conditions were affected by the presence of water power for the generation of electricity.

Mr. H. Davies emphasized the importance of pursuing investigations on the use of reflectors in street lighting, in the same way as was being done in the electrical industry, and Capt. W. J. Liberty, in a written communication, also urged that the Institution should continue to co-operate in the work of the International Illumination Commission, and should pay particular attention to the subject of street lighting.

The Gas Journal, in commenting on this discussion, admits that in the past there has been negligence in regard to lighting in some quarters; at the present time this condition of things is being altered, though the process should be accelerated. It is, however, unfortunate that at the meeting of the Commission gas interests in other countries were so inadequately represented. In the science of illumination this and other countries are, on the gas side, distinctly behind electrical competitors. This condition must be remedied. It is hoped that there will be increased interest on the part of the chief officials of gas undertakings in the scientific aspects of illumination, and that we shall see, with the passing of time, progressive application of scientific principles to the work of illumination by gas. The International Illumination Commission are now taking in hand work in which the gas men of every country should be prominently concerned.

Municipal Undertakings and Illuminating Engineering

AT the present moment, when the development of electrical supply on a much wider basis is being continually discussed, it is natural that present methods of dealing with the consumer should also be the subject of comment. Many supply engineers, especially those associated with municipal undertakings, feel that the position is unsatisfactory, in that they do not render the full "service" to consumers that should accompany the supply of electrical energy. At the I.M.E.A. Convention this was admitted by Councillor W. H. Thickett (Chairman of the Grimsby Corporation Electricity Committee), who answered the query, "Are Supply Undertakings doing their Utmost to Develop the Demand for Electricity?" by a decided negative.

There are legislative difficulties which make it difficult for municipal undertakings to render full service. In some cases enterprise has enabled these difficulties to be largely overcome. But there are still districts where practically the only communications between the undertaking and its consumers consist in the rendering of quarterly accounts. Such a condition is incompatible with the full development of the electric lighting industry, and goes far to explain why progress in this country has not been equal to that in some others. In the electrical field, as in others, Great Britain was associated with a vast amount of pioneering work. Much of the apparatus and many of the methods of to-day were evolved in this country. There is no inherent reason why it should have lost the start which it originally secured.

If the lost ground is to be made up it is essential that much more should be done to bring home to consumers of all classes *what electricity can do*. Supply undertakings must take a share in the education of the consumer. Every municipal undertaking should have a well-equipped showroom, where all the latest lighting appliances can be shown, demonstrations of good and bad methods of lighting given, and periodical lectures and discussions arranged. Work of this kind is being done very efficiently by the E.L.M.A., whose activities are expanding. But, from the standpoint of the public, as well as that of electrical supply undertakings, it is unsatisfactory that this work should be left exclusively to the lamp makers, and to manufacturers of illuminating accessories. Properly qualified consumers' engineers, who can advise the public on lighting, should be appointed and thoroughly trained. Manufacturers and supply undertakings should work together, each bearing part of the educational burden, and operating in conjunction with the Illuminating Engineering Society, in which both are represented.

The whole *modus operandi* requires careful consideration, and it is to be hoped that at the next I.M.E.A. Convention a discussion on the best means of carrying into effect these proposals will be arranged. The paper read by Mr. Lieb at the meeting of the International Illumination Commission in Geneva last year showed how valuable illuminating engineering has been to electrical undertakings in the United States, and satisfactory future progress in this country involves the application of similar methods.

Notes on The I.M.E.A. Convention

Held in Brighton during June 15th—20th, 1925

IN our last issue we summarized the paper on street lighting read by Mr. Haydn T. Harrison at the I.M.E.A. Convention held at Brighton during June 15th—20th. We now take the opportunity of briefly summarizing several other papers and addresses dealing with problems of the day.

Presidential Address.

Mr. W. P. Tapper, in his presidential address, recalled that this was the 30th annual Convention of the I.M.E.A. and the third occasion which this body has visited Brighton. At the first Convention there was an attendance of 114 persons; this year members, delegates and visitors exceeded 770. In 1895-6 the units sold by the municipalities were about 30,000,000. The latest tables give a present-day value of 2,982,287,284 units. Capital expenditure, in 1895-6 under £4,000,000, now stands at £154,418,100. These figures are striking, but the next 30 years should witness even greater progress.

One of the most useful bits of work done by the I.M.E.A. was the inauguration of the Electrical Development Association, which has done a very great work, and more than could have been expected with the somewhat meagre funds available. Another task had been that of watching changes in the law relating to electricity supply. In this connection Mr. Tapper recalled the suggestions he had made to the Special Electricity Committee of the London County Council in 1912, relative to the London problem. The actual methods adopted appear to form a compromise. Mr. Tapper urged the need of conferring full hire-purchase, selling and wiring powers upon all municipalities in the country. The opposition of contractors to this reform is misconceived. The enormous expansion in installation work resulting would bring them prosperity. Further contributions to the relief of rates from the profits of electricity supply undertakings (except as regards refunding of calls on the rates) should be prohibited. Any surplus after paying working expenses, capital charges and writing out of capital account of dead assets should be used in (1) setting up an adequate reserve, (2) reduction of charges to consumers, and (3) transfer to capital account, thus avoiding fresh borrowing and providing money for finance-hire, hire-purchase and assisted wiring schemes. A hopeful feature for the future is the setting up by the Electricity Commissioners of an Advisory Committee on methods of extending the use of electricity for domestic purposes.

Are Supply Undertakings Doing Their Utmost to Develop the Demand for Electricity?

In his paper on this subject Councillor W. H. Thickett (Chairman of the Grimsby Corporation Electricity Committee) answered the above query in the negative. In spite of recent advances, progress is still far slower than can be justified in face of the great public need for electricity in all its forms.

In this connection Councillor Thickett quoted from the speech of H.M. the King on the occasion of the opening of the new Barking Power Station, and from the Prime Minister's recent address at Oxford, both urging the importance of electricity to the nation and the coming of "an electrical age." Figures were quoted to illustrate the much greater consumption per head of population in U.S.A., Switzerland, Canada, Sweden and other countries, as compared with Great Britain. In this country the proportion of consumers of electricity is about 15 per cent. of the population; in the United States more like 25 per cent. The present turnover of electrical supply undertakings works out to roughly 1d.—2d. per day per head—the modest price of a box of matches.

The causes of backwardness are partly historical, and the speaker quoted from the Report of the Electricity Commissioners to show the inefficient conditions which it is sought to remedy. But an explanation of equal importance is the long continued failure to establish the right sort of contact with the public. Obstacles to progress included cost of appliances, lack of knowledge of electricity by the people, and cost of electricity in certain districts. Moreover, the ratio of turnover to capital is low—not more than 25 to 30 per cent. In America the ratio, generally speaking, is twice as high. In conclusion the speaker emphasized the importance of research and sane standardization, and the need for initiative in promoting wiring schemes, and above all the need for systematic education of the public in electrical matters.

Installation Policy.

Mr. L. L. Robinson, in his paper on the above subject, recalled that in the early days suppliers of electricity entirely neglected the "service to the consumer" end of the business. It was only gradually that they awoke to this responsibility and appointed "consumers' engineers," and the latter were frequently unqualified and badly paid assistants.

In the future, he contended, electricity undertakers should have full selling powers so as to be able to render service to the consumer in the same way as gas undertakings do. They should have (a) a reliable staff of experts competent to demonstrate and advise consumers on the best way to use electricity for all purposes, (b) sufficient supervision to see that the ideas of experts are properly carried out, (c) a competent staff of reliable workmen capable of tackling any kind of installation (and especially maintenance work), (d) a good sales manager (with general engineering knowledge preferred, but above all with strong personality and business ability).

The statement of these functions led naturally to a consideration of the position of the contractor. Mr. Robinson contended that the well-qualified contractor would not suffer but would benefit by the greater opportunities brought about by the propaganda work of the supply undertaking with whom he would work in co-operation. With the "curbstoners," i.e., irresponsible and unqualified firms whose work was unsatisfactory, he had little sympathy. Installation and wiring work of the ordinary small detail kind cannot bear the whole of the selling and advising costs which may easily reach 20 per cent. This kind of work must therefore be assumed by the supply undertaking, and it is necessary to find a basis of co-operation. The undertaking should be responsible for two classes of work that cannot readily be arranged by contract: (1) Special installations involving new ideas, which cannot be covered by general contracts and require personal supervision; (2) urgent maintenance service, which cannot be organized quickly enough through a third party. Otherwise there was plenty of opportunity for the genuine contractor, and he outlined various schemes of joint working, quoting the method described by Mr. W. A. Gillott, according to which a local company formed of electrical contractors is organized, orders taken in the showroom run by the municipal authority being handed over to the Company's representatives and distributed by them. The Company pays a contribution towards the upkeep of the showroom.

Amongst obstacles to the rapid development of electricity, Mr. Robinson mentioned (a) the first cost of installation and (b) the reluctance of tenants to improve landlords' property at their own cost. It is a startling fact that wiring for 40-watt points costs about £25 per kilowatt installed—greater than the installation cost of a modern power station. In order to meet these difficulties various methods, such as hire-purchase or instalment terms, or a free-wired prepayment meter system, were suggested. The final portion of the paper was devoted to a discussion of the eighth edition of the I.E.E. Wiring Rules, the author contending that these set an unduly high standard in the interests of absolute safety, but at the expense of cheap and convenient equipment.

DISCUSSION.

The papers led to an animated discussion. Mr. S. B. Langlands, commenting on Mr. Harrison's paper, mentioned that the public lighting rate in Glasgow is only 3·83d. in the £, and suggested that the ideal method of supervision was by means of an independent lighting inspector working in harmony with the City gas and electrical engineers. As an instance of the vagaries of public opinion he mentioned that the very efficient lighting of one street that was not so well liked by the public as that in an adjacent thoroughfare, where there was considerable glare. Mr. J. Christie gave an account of the lighting of the Brighton front, where 1,500-watt 50 v. gasfilled lamps are now installed, whilst in the main streets 1,000-watt and 500-watt lamps are employed according to the illumination required. Councillor J. W. Longley explained the functions of the special committee appointed in Bradford to deal with public lighting, and the general scheme of improving existing conditions by instalments. It is proposed to take the advice of an independent lighting expert as to which streets should be lighted electrically and which by gas. Mr. E. E. Hoadley described experiences in Maidstone, and Mr. W. E. Bush showed that, with the permissible tolerances for lamps in the standard specification, it should be possible to get to within 12 per cent. of calculated values of illumination. Mr. L. Gaster emphasized the importance of adequate public lighting in the interests of safety. He pointed out that in this connection a direct responsibility rested upon the local authorities, whose duty it was to eliminate all lighting conditions liable to occasion street accidents.

Mr. L. E. Robinson's paper led to a considerable amount of discussion, the standpoint of the contractor being voiced by Mr. Walter Riggs (President of the Electrical Contractors' Association), Mr. H. Marryat and others. Several speakers mentioned experiences of amicable working with contractors in connection with special wiring schemes. The general opinion appeared to be that it was quite feasible for an electricity undertaking to have full wiring powers and yet to work amicably in co-operation with local contractors successfully.

The discussion on Councillor W. H. Thickett's paper was opened by Mr. L. B. Atkinson (Chairman of the Council of the British Electrical Research Association), who appealed to municipal committees to support electrical research associations. He contrasted the position here with that in America, where single firms have laboratories with 1,500—2,000 workers, all engaged in research, and referred particularly to the necessity for supporting research of a co-operative character. Mr. C. Le Maistre likewise outlined recent work of the British Engineering Standards Association, and Mr. J. W. Beauchamp referred to the new E.D.A. scheme, which had already received substantial support.

In conjunction with the Convention there was an exhibition of heating and cooking. An effective demonstration of modern show-window lighting was also arranged by the Electric Lamp Manufacturers' Association, Ltd., a draper's window, daintily dressed, being illuminated from the side and top by light, constantly changing in colour. The E.L.M.A. was also responsible for the lighting of the reception rooms of the Royal Pavilion and the flood-lighting of its eastern front. Visitors had also an opportunity of seeing the arrangements at Mr. Berry's electric flat, and of visiting Mr. R. Borlase Matthews's electric farm at East Grinstead. An interesting item there is the use of artificial sunlight in the poultry houses, whereby the output of eggs during the winter season is increased by 20 per cent.

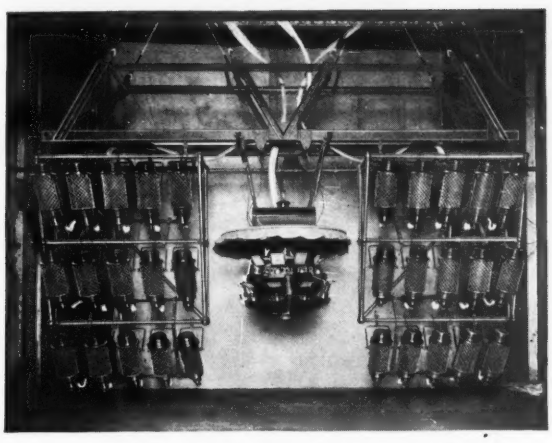


FIG. 1.—Cloud Apparatus and Horizon Floods used for projecting cloud pictures and sky effects upon a screen.

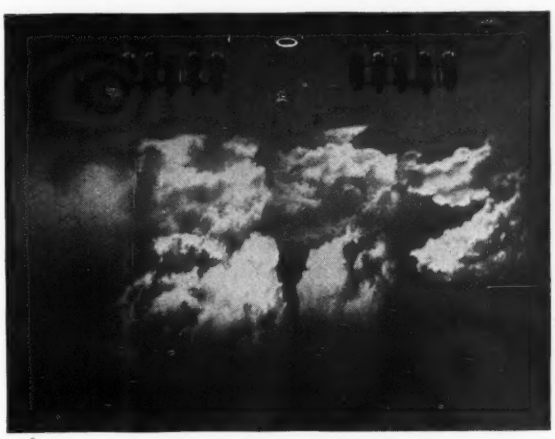


FIG. 2.—A Cloud Picture, showing bottom tier of horizon floods; the latter, of course, are not seen by patrons.

FIG. 3.—Another Cloud Picture. These clouds move across the screen, according to the movement of the cloud apparatus, in vertical and horizontal directions.

Cloud Effects on the Stage

We are indebted to the General Electric Co., Ltd., for the accompanying views showing the remarkable cloud effects obtained by projection with the apparatus shown in Fig. 1. These projectors were briefly described in a recent paper by Mr. H. R. Lester Groom, summarized in our May issue, and last year we gave an account of the striking demonstration of these methods witnessed at St. Martin's Theatre. The above photographs are, we understand, the first ones available in this country taken of actual cloud effects artificially produced on the stage.

TRADE NOTES & ANNOUNCEMENTS

THE NEW MAZDA HOUSE.

In our February issue we mentioned the development of the new Mazda House at the junction of Newman Street and Oxford Street as an illustration of the tendency towards an extension of business westwards.

On June 25th these new premises, described as the "House of Light," were officially opened. After a luncheon at the Trocadero Restaurant, an opportunity was provided for a thorough inspection of the new Mazda House, which presents many interesting features. To electrical contractors the position is considered exceptionally convenient. The building

FIG. 2.—A Corner of Main Showroom.

FIG. 1.—Exterior View of Mazda House, corner of Newman Street and Oxford Street.

itself is designed on an organized plan, all incoming orders being dealt with on the top floor, where the mailing, stationery and typists' offices are situated. On the floor below are the quarters of the administrative staff, including a conference room and a large office devoted to the lighting engineers. This is a very important section, as the Company has long made a feature of providing "lighting service," i.e., giving consumers advice as to the best use of the lamps and appliances provided.

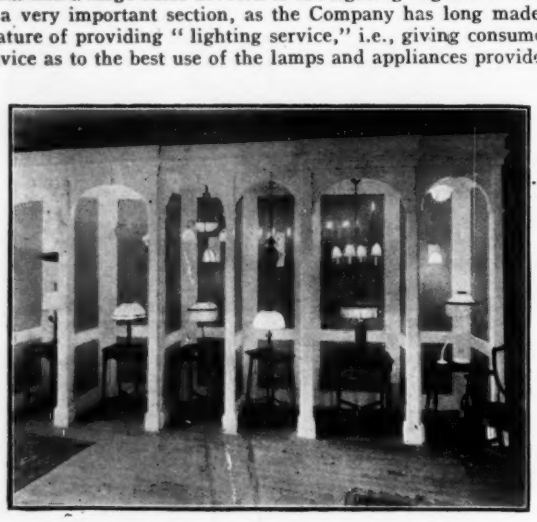


FIG. 3.—Alcoves for demonstrating individual fittings.

On the first floor are the main showrooms, including one large room running the entire length of the building and three model furnished rooms (study, dining-room and bedroom), specially fitted to demonstrate applications of domestic lighting. Arrangements are made for the substitution of any fittings in a few seconds, so that a wide variety of lighting conditions can be shown. A novel feature is the provision of an "artificial garden" visible through the drawing-room window and illuminated by artificial daylight. The problem of providing a representative collection of the chief types of modern fittings, and yet avoiding an unduly crowded effect, has received special attention. On the ground floor exceptionally interesting items are shown in bolder types of fittings. Attention may also be drawn to the alcoves serving for the demonstration of individual fittings (illustrated in Fig 3.). The lower ground floor also contains two demonstration show-windows

FIG. 4.—Ground Floor Showroom.

where variegated colour effects, undergoing continuous alterations under automatic control, may be seen. Other interesting features are the exhibit of the flood-lighting of posters by means of the "Posterlite" and the "Dayanite" sign, equally visible by day and night. Generally speaking, a special effort is made to mount distinctive fittings in harmonious surroundings. Beside designs of characteristic past types, modern bowls and fittings for semi-indirect lighting are well repre-

sented. All the fittings shown are of course equipped with Mazda lamps, and a stock of 50,000 lamps of all types and sizes is available for sale over the counter. (This is in addition to the main London stocks at the Company's Wenlock Road stores.)

The trade counters on the ground floor are conveniently sectionized, and every effort has been made to ensure speedy service and eliminate possible causes of delay. A special telephone system maintains communication with Wenlock Road, and there is a well organized motor service for urgent deliveries. An electric lift brings down goods from the stores above.

In conclusion it may be mentioned that the building is not only electrically lighted but also electrically heated throughout.

GAS LIGHTING IN WESTMINSTER SQUARE.

The above illustration, reproduced from "Public Lighting by Gas" (an illustrated booklet summarizing a lecture delivered by Mr. J. W. Lofts, of Messrs. Wm. Sugg & Co., Ltd.), may be new to many of our readers. It gives quite a good idea of the effects of the lanterns in Westminster Square, and also illustrates the effect of wide distribution of light in all directions. This is no doubt one of those situations where the concentration of all light downwards would not be advisable.

"THE BENJAMIN REFLECTOR."

An enterprising departure has been made by Benjamin Electric, Ltd., in the first issue of the above publication (July). There are several photographs of typical industrial lighting installations, and particulars of the "All-Metal" Biflector specially designed to provide an extensive distribution without glare; the method of packing is also illustrated.

A good point is scored in the opening article on "Early Lighting Business," wherein it is pointed out that the general impression that good lighting business cannot be expected until September is not correct. A graphical representative of the amount of lighting business in each month of the year shows a well marked maximum in October, and a lower peak in February; but, generally speaking, throughout August to December and again from December to May there is plenty of business to be picked up.

PHILIPS LAMPS, LTD.

In order that they may be in a position to serve Nottingham and district as expeditiously as possible Messrs. Philips Lamps, Ltd., have opened a branch in that city under the managership of Mr. Howard V. Crisp. The address is as follows: Philips Lamps, Ltd. (Nottingham Branch), 21, Stoney Street, Nottingham.

SIEMENS MONTHLY LIST.

The usual monthly price list issued by Messrs. Siemens and English Electric Lamp Co., Ltd., contains particulars of all leading types of standard lamps, including those of the daylight, enamelled gasfilled, and colour-enammelled varieties. Some useful semi-indirect fittings and reflectors, including show-window units, are also shown, and as usual a feature is made of "Zed" safety fuseboards and fuses.

A LAUGH AT THE "SHOP HOURS ACT."

Under the above title a readable booklet has been issued by Electric Service, Ltd., pointing out the advantages of keeping windows illuminated after business hours. There are several telling illustrations showing how good illumination attracts customers, and a diagram shows how, when bare lamps or inefficient shades are used in a window, as much as 75 per cent. of the light may be wasted. The lesson conveyed in the booklet, that good illumination pays, and that merchants can obtain a very cheap and effective advertisement by continuing the lighting when the shop is closed, is fully endorsed by experience.

CONTRACTS CLOSED.

The following contracts are announced:—

MESSRS. SIEMENS and ENGLISH ELECTRIC LAMP CO., LTD.:

London Midland and Scottish Railway Co., Derby; renewal of contract for the supply of Siemens gasfilled lamps.

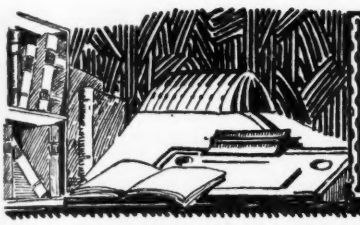
Royal Mail Steam Packet Co.; tender for the whole of their requirements of gasfilled lamps, as well as for a considerable number of metal filament and carbon filament lamps for the next twelve months.

The Aberdeen Line (Messrs. George Thompson & Co., Ltd); renewal of contract for the supply of Siemen's traction gasfilled and carbon filament lamps.

MESSRS. THE GENERAL ELECTRIC CO., LTD.:

London Midland and Scottish Railway Co.; extension of contract for Osram gasfilled lamps and vacuum train-lighting lamps for a further period of six months.

Other recent orders include a three years' *War Office* contract for Osram vacuum lamps for Home Commands, and for Osram gasfilled lamps for Home Commands and stations abroad; and a six months' contract from the *London and North-Eastern Railway*, Northern and Scottish Area, for Osram vacuum and gasfilled lamps and Robertson carbon filament lamps.



REVIEWS OF BOOKS AND PUBLICATIONS RECEIVED

LIGHT AND COLOUR IN ADVERTISING AND MERCHANDISING, *by M. Luckiesh; with 38 illustrations in colour and tone. Demy 8vo., 268 pages. D. Van Nostrand Company, New York, U.S.A. Crosby Lockwood, London; 16s.*

Few names are better known in connection with the study of the fundamental principles of light and shade, of colour and tone in illumination and display, than Mr. Luckiesh. He has won a reputation with his previous books, nine in number, which is worthily upheld by the present volume.

We are given an excellent collection of studies from different aspects of the great subject of commercial display, ranging from the broad characteristic of colour with their preference and emotional values and symbolic usage, to the more practical material dealing directly with attention-value and effectiveness of colours. Next we have a conclusive disquisition proving the immense value of light over against mere pigment, and its utility in the show window and displays in stores. He concludes with further reference to distinctive interiors and electrical advertising, with a few words on the æsthetic sense.

It is a catholic production, and the range of subjects above mentioned indicates its utility to nearly everybody connected with the practice of commercial display. From the planning of the building by the architect and its decoration by the painter, to the design and installation of proper illuminating devices of the latest type, he goes to the actual arrangement of colour and light as seen by the eye of the general public. And when it is said that he makes it clear throughout that he takes the view that it is the ultimate effect on public psychology that is the final test, we have made his aim evident as a thoroughly practical one.

This book will become a classic on the subject of display, an art as yet in its infancy. Although the author makes no large and extravagant claims on behalf of his work, he is sufficiently expert to realize the vastness of the scope of commercial display! "The final word," says he, "has not been written in these chapters; indeed, this volume is but a beginning." Let us add: "It is well begun, and thus half-done," and it is but the obvious fact that great improvements in technical material, lamps and fittings, will slowly compel revision and addition to this notable work.

The book teems with pungent remarks, which can only arise from one thoroughly familiar with colour and light, and we must resist the great temptation to quote. But we must refer to his comment on "the age of mere light" and the present "age of more light" to-day, with "adequate light."

Mr. Luckiesh realizes the necessity of expert guidance in these matters. "It is not," he says, "the hope or intention to set forth simple rules whereby a mechanic can become a successful merchant by merely beckoning light and colour to his aid. The web is too intricate to be completely untangled." He insists on the value of psychology, knowing that the primary appeal must be aimed at the mind through the vision, to be successful. He produces conclusive evidence for the value of colour in every direction, whether in print, in display of materials, or in lighting. He shows colour to be purely relative, influenced by adjacent colour, by tone, by its illumination, and by position. The work is one of value for the illuminating engineer, particularly those whose work leads them into departmental and provincial stores. No technical data are given, as it is a book not for the elementary student, but for the practical man. We recommend the book as one of the greatest value.

W. C. R.

INDEX (July, 1925).

See also page 194

SPECIAL NOTICE

The **BACK NUMBERS** of *The Illuminating Engineer* covering the period 1908-1924, contain a most valuable record of developments in illuminating engineering, and in which accounts of papers and discussions on practically all aspects of lighting are included.

Owing to the great demand for many issues, the stock of some is extremely limited, but copies of almost all can be supplied on application.

The cost of volumes (unbound) will in future and until further notice be as follows:—

Vols.	I—X	(1908-1917)	.....36s. per vol.
Vols.	XI—XV	(1918-1922)	.....30s. ,,
Vols.	XVI—XVII	(1923-1924)	.....18s. ,,

Special binding cases for nearly all these volumes will be supplied at a cost of 4s. each.

A booklet summarizing the development of the Illuminating Engineering Society Movement during the period 1908-1922, and containing a list of all papers and discussions before the Illuminating Engineering Society throughout this period, will be sent free to anyone interested.

"Light and Illumination—Their Use and Misuse," an illustrated booklet containing a few general Recommendations on Lighting; a few copies still available (3d. each, post free 4d.)

Applications should be addressed to THE ILLUMINATING ENGINEER *(The Journal of GOOD LIGHTING), 32, Victoria Street, London, S.W. 1.*